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S. P. LANGLEY,
Secretary S. I.

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856

AN INDEX

TO THE

GENERA AND SPECIES

OF THE

FORAMINIFERA

BY

CHARLES DAVIES SHERBORN.

PART I. A TO NON.

CITY OF WASHINGTON.
PUBLISHED BY THE SMITHSONIAN INSTITUTION.
NOVEMBER, 1893.

PREFATORY NOTE.

THE preparation of the manuscript of this index occupied the years between 1885 and 1889. The printing was commenced in 1890, and owing to the considerate kindness of the Smithsonian Institution in the matter of proofs, it has been found practically impossible to complete the work before the end of 1894; and therefore it has been thought advisable to issue the first half—comprising the material A to Non.—as Part I. Part II (the concluding portion) will be issued as soon as ready, accompanied by a preface and such emendations as may be found necessary. For the latter particulars, I shall be mainly indebted to my friend Fortescue William Millett, whose knowledge of the literature of the subject is remarkable and peculiar.

C. DAVIES SHERBORN,

540 King's Road, London, S. W.

OCTOBER, 1893.

AN INDEX

TO THE

GENERA AND SPECIES

OF THE

FORAMINIFERA.

ACANTHOSPIRA, Reinsch, 1877. Neues Jahrb. 1877, 177. [Proposed but not described; "Cornuspiridæ."]

ACERVULINA, Schultze, 1854. Organismus Polythal. 1854, 67. [Referred to *Gypsina*, by H. B. Brady.]

——— **acinosa**, Schultze. *Ibid.* 68, vi, 15.

——— **cretæ**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, x, 1878, 171, v, 39*ab*.

——— **globulosa**, Schultze. Organismus Polythal. 1854, 68, vi, 13, 14.

——— **[globosa]** ——— Claus, Lehrbuch d. Zool. 1885, 156, f. 140.

——— **inhaerens**, Schultze. Organismus Polythal. 1854, 68, vi, 12. [v. *Gypsina*].

——— ——— ——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 72, vi, 17.

——— Harting, Magt van het Kleine, 1866, 107, f. 47.

——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 206, viii, 17.

ACICULARIA, d'Archiac, 1843. Mém. Soc. géol. France, v (2), 1843, 386. [A genus of Calcareous Algæ, formerly classed with the Foraminifera.——. v. Munier-Chalmas, Comptes Rendus, LXXXV, 1877, 814, etc.; Solms-Laubach, Einleit. Paläophytologie, 1887, 38, etc.

——— **pavantina**, d'Archiac. Mém. Soc. géol. France, v (2), 1843, 386, xxv, 8*a*.

——— Reuss, Sitz. k. Ak. Wiss. XLIII (1), 1861, 7–10, plate.

——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 137, xi, 27–32.

ACTEONINA minuta, Swallow? [Quoted by Bigsby, Thes. Dev.-Carb., 1878, p. 200—presumably an error.

ACTINOPORELLA, Alth, 1882. Alth, Mojs. u. Neumayr's Beiträge, I, 1882, 321–323 [in the original work in Pamietnik akad. Umiej. Krakowie, VI, 1881, 135, the genus is given as *Gyroporella*]. [A genus of Calcareous Algæ, included by Alth and by Gümbel in the Foraminifera: for *Gyroporella*, see Solms-Laubach, Einleit. Paläophytologie, 1887, 38, etc.]

ADELOSINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 303. [This genus was considered by Parker & Jones to be merely a young form of the Miliolinæ, and their views were accepted for many years by most naturalists; recently, however, Schlumberger in Bull. Soc. Zool. France, XI, 1886, 544, has contended for the generic value of *Adelosina*.]

——— **bicornis** [Walk. & Jacob]. Gosse, Manual mar. Zool. 1855, 14, f. 22. [*Serpula* 1798.]

——— ——— ——— Schlumberger, Bull. Soc. Zool. France, XI, 1886, 546, f. 1–5, 7&8; xvi, 10–15.

ALLOMORPHINA trigona, Reuss. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl. 71.
——— ——— ——— Brady, Q. Journ. Micr. Science, XIX, 1879, 281, viii, 13, 14.
——— ——— ——— Brady, Report Challenger, 1884, 438, lv, 24–26.
——— ——— ——— var. **obtusa**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 225, vii, 11.
——— ——— ——— Rzehak, Ann. k. k. nat. Hofmuseums, III (3), 1888, 259, xi, 2*abc*.
ALLOTHECA, Ehrenberg, 1841. Abhandl. k. Ak. Wiss. Berlin, 1841, 407.
——— **megathyra**, Ehr. *Ibid.*, 1841, 426, III, vii, 49. [=*Planorb. farcta*, young; with coarse pores.]
——— **rotalia**, Ehr. Mikrogeologie, 1854, xxiii, 32. [=? *Globigerina;* called elsewhere *Rotalia globulosa.*]
ALVEOLINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 306; Parker & Jones, Ann. Mag. Nat. Hist. [3], VIII, 1861, 161; Brady, Report Challenger, 1884, 221.
——— **acuta**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 206, no fig.
——— **boscii** (Defrance). D'Orbigny, Ann. Sci. Nat. VII, 1826, 306, No. 5. [*Oryzaria*, 1820.]
——— ——— ——— D'Orbigny, Modèles, No. 50, 1826.
——— ——— [d'Orb.] Bronn, Lethæa Geognostica, ed. 2, 1837, 1148, xlii, 34*ab*.
——— ——— ——— Carpenter, Phil. Trans. 1856, 552–555, XXVIII, 23, 24; xxix, 4–9.
——— ——— ——— Beudant, Géologie, ed. 8, 1858, 117, f. 107; later eds. same fig.
——— ——— ——— P. J. & B. [d'O. Modèles 50], Ann. Mag. Nat. Hist. [3], XVI, 1865, 26, i, 23. [=*A. sabulosa*, Montf.]
——— **[bosci]**, [d'Orb.] Zittel, Handbuch Palæont. I, 1876, 79, f. 13[6], & 14.
——— **[bosei]**, [d'Orb.] Schwager Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl. 112.
——— ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 79, iii [numbered iv by error] 13–15; iv [numbered iii by error] 1. [Structure.]
——— ——— [d'Orb.] Terq., Mém. Soc. Géol. France, [3], II, 1882, 50, II (x), 30.
——— ——— ——— Brady, Report Challenger, 1884, 222, XVII, 7–12.
——— **[bosci]**, [d'Orb.] Hoernes, Elem. Palaeont. 1884, 34, f. 29; French ed. 1886, same fig.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 164, fig.
——— **[bosci]**, ——— Gümbel, Geol. Bayern, I (2), 1885, f. 266[12].
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, V (1885), 1057, lxxxvi, 46.
——— **[bosci]**, [d'Orb.] Fritel, Foss. caract. terr. sedim. (tert). 1886, vii, 57.
——— ——— ——— Steinmann, Elem. Paleont. I, 1888, 24, f. 6*a*.
——— ——— v. *Nautili diversæ speciei.*
——— **bulloides**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 306, No. 1.
——— ——— ——— Guérin-Ménéville's Cuvier, Iconographie, Mollusques, 1829–43, 10, III, 12.
——— ——— ——— Cuvier, Animal Kingdom, (Henderson's ed.), III, 1834 (pls. 1837), 19, vi, 11.
——— **compressa**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 210, No. 357. [v. *Lacazina.*]
——— **costulata**, Eichwald. Lethæa Rossica, III, 1853, 8, i, 4*abc*. [*Melonia*, 1830.]
——— **cylindrica**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 205, no fig.
——— **(Flosculina) decipiens**; Schwager. Palæontographica, XXX, 1883, Pal. Theil, 103, xxvi (3), 1 *a-k*; xxv (2), 1*a-g*.
——— **depressa**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 140, no fig.
——— **ellipsoidalis**, Schwager. Palæontographica, XXX, 1883, Pal. Theil, 96, xxv (2), 1*a-i*; 2*a–c*. [v. *Schwagerina.*]
——— **elliptica**, [d'Orb.], Sowerby. Mantell, Pictorial Atlas Foss. Rem. 1850, 142, lxi, 28–31. [*Fasciolites*. 1837.]
——— **elongata**, d'Orbigny, Ann. Sci. Nat. VII, 1826, 307, No. 6.
——— ——— ——— Dixon, Geol. etc. Sussex, 1850, 85, ix, 4.
——— ——— ——— Terq., Mém. Soc. Géol. France [3], II, 1882, 50, ii, (x), 31.
——— ——— ——— Fritel, Foss. caract. terr. sedim. (tert.) 1886, VII, 56.
——— **eximia**, Terquem. Mém. Soc. Géol. France [3], II, 1882, 51, ii, (x), 32.
——— **fortisii**, Massolongo. Schizzo valle Progno, 1850, 19, no fig.

ALVEOLINA spheroidea, (Lamarck). Medlicott & Blanford, Geol. of India, 1879, 459, xv, 9 [*Melonites*, 1816].
—— **sphæroidea**, (Fort.) f. **Guardiolæ**, De G. De Gregorio, Fauna Argille Scagliose, 1881, 46, i, 13, 14; iii, 3. [*Discolithus sphæroideus oblongus*, 1802.]
—— **spiralis**, Cornalia & Chiozza. Giorn. I. R. Ist. Lombardo, n. s. III, 1851, 39, iii, 7*ab*.
—— **stercusmuris**, Mayer-Eymer. Vierteljahrsschr. nat. Ges. Zürich, XXXI, 1886, 253 ['aehnlich der *Alv. oblonga*, weniger cylindrisch, langs schwach gerunzelt'].
—— **subpyrenaica**, Leymerie. Mém. Soc. Géol. France [2], I, 1844, 359, xiii, 9*abc*.
—— —— —— v. **globosa**. *Ibid.* [2], I, 1844, 359, xiii, 10*a,b,c*.
—— **trinodis**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 206, no fig.
—— Deluc, Journ. de Physique, LIV, 1802, 179, i, 11–14.
—— Ansted, Geology, 1844, ii, 63, f. *g*.
—— Pictet, Traité de Paléont. IV, 1846, 231, xii, 14.
—— Rütimeyer, Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, iv, 58–60.
—— Ehrenberg, Abhandl. Ak. Ak. Wiss. Berlin, 1855, 172, v, xvii. [Glauc. cast.]
—— Carpenter, Ency. Brit., Foraminifera, 9th ed., IX, 1879, 377, f. 10.
ALVEOLINEA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. i. [A family group name.]
ALVEOLITE grain de fétuque, C. Bosc. Bull. Sci. Soc. Philom. III, No. 61, 1811, 99, v, 3*A,B,C*.
ALVEOLITE grain de millet, C. Bosc. *Ibid.* III, No. 61, 1811, 99, v, 4 *A,B,C*.
ALVEOLITES, Defrance, 1816. Dict. Sci. Nat. I, 1816, 137.
—— **larva**, Defrance. *Ibid.* I, 1816, 137.
AMMODISCUS, Reuss, 1861. Sitz. Ak. k. Wiss. Wien, XLIV (1), 1861 (1862), 365; Brady, Report Challenger, 1884, 329.
—— **charoides** (Jones & Parker).
? —— (**Trocham.**) —— —— Bütschli in Bronn, Klassen, &c. Thier-Reichs, 196, v, 21 [*Trochammina*, 1860].
—— —— —— Brady, Report Challenger, 1884, 334, xxxviii, 10–16.
—— —— —— Balkwill & Wright. Trans. R. Irish Ac. XXVIII (Sci.), 1885, 330, xiii, 10.
—— **filum** (Schmid). Haeusler, Neues Jahrbuch, Beil. IV (1), 1885, 26, iii, 23 [*Serpula* 1867].
—— **gaultinus**, Berthelin. Mém. Soc. Géol. France [3], I, 1880, 19, i (xxiv), 3*ab*.
—— (**Trocham.**) **gordialis**, Jones & Parker. Bütschli in Bronn, Klassen &c. Thier-Reichs, 1880, 196, v, 22 [*Trochammina*. 1860]
—— —— —— Brady, Report Challenger, 1884. 333, xxxviii, 7–9.
—— —— —— Haeusler, Neues Jahrbuch, Beil. IV, (1), 1885, 24, iii, 10–22 and 31.
—— —— —— Brady, Parker, & Jones, Trans. Zool. Soc., XII (7), 1888, 218, xlii, 22.
—— (**Glomospira**) —— —— Rzehak, Verh. k. k. geol. Reichs., 1888, p. 191.
—— —— —— Steinmann, Elem. Paleont. I, 1888, 26, 7*C*.
—— (**Trocham.**) **incertus** (d'Orbigny). Bütschli in Bronn, Klassen &c. Thier-Reichs, 1880, 196, v. 20 [*Operculina*, 1839].
—— —— —— Brady, Report Challenger, 1884, 330, xxxviii, 1–3.
—— —— —— Haeusler, Neues Jahrbuch. Beil. IV (1), 1885, 19, ii, 12–18; iii, 1–9 [fig. 14 is descr. as var. *crassus*; 15, v. *tuberculatus*; 17, v. *gracilis*; 18, v. *megospira*].
—— —— —— Bornemann, Jahrb. k. pr. geol. Landesanstalt, 1885 (1886), 293, xiii, 3, 4 and 5
—— —— —— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 484, xi, 7.
—— —— —— Mariani, Bull. Soc. Geol. Ital. VII (1889), 284, x, 1.
—— **infimus** (Strickland). Bornemann. Zeitschr. deutsch. geol. Ges. XXVI, 1874, 725, xviii, 4–7; xix, 8 [*Orbis*, 1846].
—— —— —— Schwager. Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 79.
—— **jurassicus**, Haeusler. Neues Jahrbuch, Beil. IV, (1), 1885, 26, iii, 33, 34.

AMPHICORYNE falx (Jones & Park.). Brady, Report Challenger, 1884, 556, lxv, 7–9. [*Marginulina*, 1860.]

AMPHIGRAMMA, Reinsch, 1877. Neues Jahrb. 1877, 177 [proposed but not described; "Globigerinidæ"].

AMPHIMORPHINA, Neugeboren, 1850. Verh. Mitth. siebenbürg. Ver. Nat. I, 1850, 125.

—— **haueriana**, Neugeboren. *Ibid.* I, 1850, 127, iv, 13–16 [*A. hauerana*, 1860].

—— [**hauerana**], ——. Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 240, xxxv[4], 40*a-d*.

—— [**hauerana**] —— Karrer, Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 705, i, 6.

—— [**haueri**] —— Reuss' Model, No. 68, 1865 (Catal.No. 51, 1861).

—— [**hauerina**] —— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 9.

—— **striata**, Reuss. Sitz. Ak. k. Wiss. Wien, XLVI (i), 1862 (1863), 57, v, 5.

AMPHISORUS hemprichii, Ehr. Abhandl. Ak. k. Wiss. Berlin, 1838, 130, iii, f. iii [v. *Orbitolites*].

AMPHISTEGINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 304; Brady, Report Challenger, 1884, 739.

—— **antillarum**, Williamson. Trans. R. Micr. Soc. III, 1849, 111, xvii, 3 [structure].

—— **aucklandica**, Karrer. Novara-Exped., Geol. I, 1864, 85, xvi, 19.

—— **bilobata**. d'Orbigny. Ann. Sci. Nat. VII, 1826, 304, No. 4.

—— **campbelli**, Karrer. Novara-Exped., Geol. I, 1864, 84, xvi, 18.

—— **clypeolus**, Reuss. Zeitschr. deutsch. geol. Ges., VII, 1855, 275, ix, 9.

—— **cumingii**, Carpenter. Phil. Trans. 1859, 32, v, 13–17.

—— **excavata**, Terq. Mém. Soc. Géol. France [3], II, 1882, 124, xiii (xxi), 2*a*, *b*.

—— **fleuriausi**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 304, No. 7.

—— —— —— Reuss, Sitz. Ak. k. Wiss. Wien, XLIV (i), 1861 (1862), 308, l, 10–12.

—— **gibba**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 304, No. 6.

—— **gibbosa**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, Foraminifères, 120, viii, 1–3, also in Spanish, 1840, 120, same pl. and fig.

—— —— —— Williamson, Trans. R. Micr. Soc. III, 1849, 106, xvii, 1 and 2 [structure].

—— **gigantea**, Karrer. Sitz. Ak. k. Wiss. Wien, L (i), 1864 (1865), 711, ii, 16.

—— **hauerina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 207, xii, 3–5.

—— —— —— d'Orb., Cours élém. Paléont. etc. I, 1849, 201, f. 328; II (2), 1852, 795, f. 609.

—— —— —— Harting, Magt van het Kleine, 1849, 111, f. 4; German by Dr. A. Schwarzkopf, 1851, 81.

—— —— —— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 205, xxxv[2], 24*a.b*.

—— [**haueri**], —— Suess, Boden Stadt Wien, 1862, 113, f. 16[2].

—— —— —— Roemer, Geologie von Oberschlesien, 1870, 394, xli, 9–11.

—— [**haueri**], —— Zittel, Handbuch Palæont. (1), 1876, 95, f. 34.

—— [**haueri**], —— Schwager, Coll. R. Com. Geol. Ital. VIII, 1877, 25, pl. 19.

—— [**haueri**], —— Credner, Elem. d. Geol. 1883, 700, f.

—— —— —— Jones, in Micrdeveloped Dict. ed. 4, 1883, 37, xxiv, 28*a*, *b*.

—— [**haueri**], —— De Lapparent, Traité de Géologie. 1883. 1032. f.

—— [**haueri**], —— Amicis, Atti Soc. Tosc. Sci. Nat. (Mem.) VII, 1885, 242, etc., xi, 4 and 5.

—— **javanica**. Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 165, iii, vii–ix. [Glauc. cast.]

—— —— —— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 71, viii, 4 [sarcode].

—— **lessonii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 304, No. 3, xvii, 1–4. [*Quoii* in descrip. of plate].

—— —— —— D'Orb., Modèles, No. 98, 1826.

—— —— —— Guérin-Méneville's Cuvier, Iconographie, Mollusques, 1829–43, 10, iii, 11.

—— —— —— Cuvier, Animal Kingdom (Henderson's ed.) III, 1834 (pls. 1837), 19, vi, 10.

AMPHISTEGINA (Section of shell-wall, showing parietal canals). Williamson, Pop. Sci. Rev., IV, 1865, 173, viii, 15.
——— See Lenticulæ.
AMPHORINA, d'Orbigny, 1849. Dict. universel d'Hist. Nat. (Chas. d'Orbigny's) v, 1849, 666.
——— **acuminata** Seguenza. Foram. monotal. miocen. Messina, 1862, 51, i, 35 [= *L. gracillima*, Seg.].
——— **costata**, Seguenza. *Ibid.* 1862, 51, i, 41.
——— **cylindracea**, Seguenza. *Ibid.* 1862, 51, i, 36 [= *L. gracillima*, Seg.].
——— **distorta**, Seguenza. *Ibid.* 1862, 52, i, 38 [= *L. gracillima*, Seg.].
——— **elongata**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 122, xi, 12*a*, *A*
——— **elongata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 51, i, 34 [= *L. apiculata*, Rss.].
——— **globosa**, Seguenza. *Ibid.* 1862, 50, i, 31 [= *L. globosa*, Mont., var.].
——— **gracillima**, Seguenza. *Ibid.* 1862, 51, i, 37 [v. *Lagena*].
——— **gracilis**, Costa. Atti Accad. Pontaniana, VII (2), 1856, 121, xi, 11*a*, *A*.
——— **lyelii**, Seguenza. Foram. monotal. miocen. Messina, 1862, 52, i, 40 [*lyellii*, p. 82] [v. *Lagena*].
——— **olivæformis**, Seguenza. *Ibid.* 1862, 50, i, 33.
——— **punctata**, Seguenza. *Ibid.* 1862, 52, i, 39.
——— **tenuicalcar**, Seguenza. *Ibid.* 1862, 50, i, 32 [= *L. globosa*, Mont., var.].
AMYGDALINA, Costa, 1838. Fauna Regno Napoli, 1838, Foraminiferi, 6; Atti Accad. Pontaniana, VII (2), 1856, 120.
——— **calabra**, Costa. *Ibid.* 1838, Foraminiferi, 6, ii, 1*a*, *A*, *B*, *C* [very like the Ostracod *Bairdia subdeltoidea*.]
——— ——— ——— Costa, Atti Accad. Pontaniana, VII (2), 1856, 120, xi, 6–8 [error for 7].
——— **truncata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 73, ii, 52 and 53 [52 = Ostracod (*Bairdia* fide Reuss); 53 = *L. marginata*, W. and J.].
——— **tubulosa**, Seguenza. *Ibid.*, 73, ii, 51 [= Ostracod (*Bairdia* fide Reuss)].
AMYGDALITES, Costa, 1839. Atti R. Acc. Sci. Borbon. IV, 1839, 186 [v. *Amygdalina*].
——— **calabra**, Costa. *Ibid.*, IV, 1839, 186 [no figure].
ANDROMEDES, Montfort, 1808. Conch. syst. I, 1808, 39, 10th Genre [= *Polystom. strigillata*].
ANNULINA, Terquem, 1862. Mém. Ac. Imp. Metz, XLII, 1862, 432.
——— **metensis**, Terquem. *Ibid.* XLII, 1862, 433, v, 6*a*,*b*.
——— ——— ——— Pornemann, Zeitschr. deutsch. Geol. Ges. XXVI, 1874, 736, xviii, 8–10.
——— **quinquelobata**, Terquem. Sixième Mém. Foram. Lias, 1866, 475, xix,5 *a*,*b*.
ANOMALINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 282; Brady, Report Challenger, 1884, 671.
——— **ammonoides** (Rss.) Brady, Report Challenger, 1884, 672, xciv, 2, 3 [*Rosalina*, 1845].
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII (7), 1888, 228, xlv, 19.
? ——— **anomala**, Egger. Neues Jahrbuch, 1857, 280, ix, 10–13.
——— **ariminensis**, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 282, No. 2 [non *Planulina* which is now *Anomalina ariminensis*].
——— **ariminensis** (d'Orb.) Brady, Report Challenger, 1884, 674, xciii, 10, 11. [*Planulina*, 1826].
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII (7), 1888, 228, xlv, 20–22.
——— **auricula**, Roemer. Verst. n.-d. Kreide, 1840–'1, 98, xv, 26.
——— **austriaca**, d'Orbigny. Foram. Fossiles Vienne, 1846, 172, x, 4–9.
——— ——— ——— Schwager, Coll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 50.
——— ——— ——— = *Planorbulina*, v. *Hammonita*.
——— **badenensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 171, x, 1–3.
——— **bengalensis**, Schwager. Novara-Exped., Geol. II, 1866, 259, vii, 111.
——— **calymene**, Gümbel. Brady, Challenger, p. 627 [*Rosalina*, 1868].

ANOMALINA scrobiculata, Schwager. Palæontographica, xxx, 1883, Pal. Theil, 129, xxix, (6), 18 *a–d*.
scutellata, Terquem. Ess. Anim. Plage Dunkerque, (1), 1875, 33, iv, 9 *a*,*b*,*c* (and Mém. Soc. Dunkerquoise).
—— **simplex**, Terquem. *Ibid.* (1), 1875, 33, iv, 8 *a*,*b* (and Mém. Soc. Dunkerquoise).
—— **subæqualis**, Reuss. Sitz. Ak. k. Wiss. Wien, XVIII, 1856, 244, v, 59.
—— **suessi**, Karrer. *Ibid.* XLIV (i), 1861 (1862), 447, ii, 2.
—— **tenuissima**, Reuss. *Ibid.* XVIII, 1856, 244, v, 60.
—— **truncata**, Terq. Mém. Soc. Géol. France, [3], II, 1882, 96, x (xviii), 8*a–c*.
—— **tuberculata**, Terq. Ess. Anim. Plage Dunkerque, (1), 1875, 33, iv, 11 *a*,*b*,*c* (and Mém. Soc. Dunkerquoise).
—— **variolata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 170, ix, 27–29.
—— —— —— Bronn, Klassen, Ordn. Thier-Reichs, I, 1859, 70, vi, 8*a*,*b*,*c*.
—— —— —— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 207, viii, 8.
—— —— —— **v. evoluta**, Walther. Mitth. Zool. Stat. Neapel, VIII, 1888, 382, xx, 3.
—— **wullerstorfi**, Schwager. Novara-Exped., Geol. II, 1866, 258, vii, 105 and 107 [v. *Truncatulina*].
—— sp. Sherborn & Chapman. Journ. R. Micr. Soc. [2], VI, 1886, 757 [fig. in text, No. 156].
—— Sander Rang. Manuel Hist. Nat. Mollusques, 1829, 107, i, 6.
—— Williamson. Mem. Lit. Phil. Soc. Manchester, [2], VIII, 1848, 75, pl., 59.
—— v. Schlicht, "Foram. Septar. Pietzpuhl." 1870, xxi, xxii.
—— sp., K. Miller. Schr. Ver. Gesch. Bodensee, VII, 1877 [78], iv, 29 [cast or concretion?].
ANONIALINA, Terquem, 1875. Misprint for Anomalina.
ANTALEN, see **DENTALEN**.
ANTENOR diaphaneus, Montfort. Conch. syst. I, 1808, 71, 18th Genre [= *Crist. calcar*].
APHROSINA, Carter, 1879. Journ. R. Micr. Soc. II, 1879, 500.
—— **informis**, Carter. *Ibid.* II, 1879, 500, xvii*a*. 5–11.
APIOPTERINA, Zborzewski, 1834. Nouveaux Mém. Soc. Imp. Nat. Moscou, III, 1834, 311.
—— **d'orbigni**, Zborz. *Ibid.* III, 1834, 311, xxviii, 2*b* [v. *Polymorphina*].
ARCHÆDISCUS. Brady, 1873. Annals and Mag. Nat. Hist. [4], XII, 1873, 286.
—— **gallicus**, Meunier. Bull. Soc. Hist. Nat. Autun, I, 1888, 236, vii, 7.
—— **karreri**, Brady. Ann. Mag. Nat. Hist. [4], XII, 1873, 286, xi, 1–6.
—— —— —— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 142, xi, 1–6.
—— —— —— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 44.
—— —— —— Nicholson, Manuel Palæont. 1879, i, 118, f. 18, *r*.
—— —— —— Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 77, ii, 5; vii, 4 and 5.
—— —— —— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880 209, ix, 13.
ARCHÆLAGENA, Howchin, 1888. Journ. R. Micros. Soc. 1888, 539.
—— **howchiniana**, (Brady). *Ibid.* 1888, 540, ix, 18 [*Lagena*, 1876].
ARCHÆOSPHERINÆ, Dawson, 1876. Proc. Amer. Assoc., 1876 (Detroit), 101, f. 3.
ARCHAIAS spirans, Montfort. Conch. syst. I, 1808, 191. 48th Genre [= *Orbic. adunca*, v. *angulata*].
ARCHIACINA, Munier-Chalmas, 1878. Bull. Soc. Géol. France, [3], VII, 1879, p. 445.
—— **armorica** (d'Arch.). *Ibid.* [*Cyclolina*, 1868.]
—— **munieri**, Schlumb. F. Jeun. Nat., July, 1883, 107, iii, 2, 2*a*.
"ARENACEOUS FORAMINIFER," Parfitt. Annals and Mag. Nat. Hist. [4], VII, 1871, 158, xi, 9–12 [= ? ; from Carbonif. Devonshire].
ARENISTELLA agglutinans, P. Fischer. Les fonds de la Mer, II, 1875, 27 and 51 ["de petits corps stelliformes, agglutinant le sable et les foraminifères, et rappelant *l'Orbitolites stellata*"].
ARETHUSA, Montfort, 1808.
—— **corymbosa**, Montf. Conch. syst. I, 1808, 303, 76th Genre [= *Polym. lactea.*]

ARISTEROSPIRA melo, Ehrenb. *Ibid.* 1858, 16.
——— **menipeæ**, Ehrenb. *Ibid.* 1858, 17.
——— **microstigma**, Ehrenb. *Ibid.* 1872, 279.
——— **microtetras**, Ehrenb. *Ibid.* 1861, 303.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 2.
——— **nidulus**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 279.
——— **octarchæa**, Ehrenb. *Ibid.* 1858, 310 and 337, i, xii, [Glauconite] [? Rotaline].
——— **omphalotetras**, Ehrenb. *Ibid.* 1872, 279.
——— ——— ——— Ehr., Abh. Ak. k. Wiss. Berlin, 1872 (1873), iii, 15.
——— **pachyderma**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 303 [v. *Globigerina*].
——— ——— ——— Ehr., Abh. Ak. k. Wiss. Berlin, 1872 (1873), i, 4.
——— **phanerostomum**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 280.
——— **platypora**, Ehrenb. *Ibid.* 1858, 17.
——— ——— ——— Ehr., Abh. Ak. k. Wiss. Berlin, 1872 (1873), xi, 20.
——— **polysphæra**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 280.
——— **porosa**, *cf. Planulina porosa*, Ehrenb. *Ibid.* 1861, 303.
——— ——— ——— Ehr., Abh. Ak. k. Wiss. Berlin, 1872 (1873), i, 3 [*cf. Planulina* and *Copopleura ocellata*, 1854].
——— **schaffneri**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 278.
——— ——— ——— Ehr., Abh. Ak. k. Wiss. Berlin, 1872 (1873), iv, 16.
——— **scutata**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 303 [= "*Planulina*," Ehrenberg].
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 14.
——— **sparsa**, Ehrenb. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 17.
——— **tremalophæna**, Ehrenb. *Ibid.* 1858, 17.
——— **undulata**, Ehrenb. *Ibid.* 1858, 18.
ARLICULINA, Giebel, 1852. Misprint for *Articulina*.
ARTICULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 300. Brady, Report Challenger, 1884, 182.
——— **compressa**, Reuss. Neues Jahrbuch, 1853, 673, ix, 3*a,b*.
——— **conico-articulata** (Batsch). Brady, Report Challenger, 1884, 185, xii, 17, 18; xiii, 1, 2 (*Nautilus*, 1791).
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 216, xl, 7–9.
——— **funalis**, Brady. Report Challenger, 1884, 185, xiii, 6–11.
——— ——— var. **inornata**, ——— *Ibid.* 1884, 186, xiii, 3–5.
——— **gibberula**, Jones. See *gibbosula*.
——— **gibbosula**, d'Orbigny. Foram. Fossiles Vienne, 1846, 282, xx, 16–18.
——— ——— ——— Pictet, Traité de Paléont. ed. 2, IV, 1857, 525, cix, 45.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 151, xv (xxiii), 25, 26.
——— [**gibberula**], Jones, in Microgr. Dict. ed. 4, 1883, 76, xxiii, 9*a,b*.
——— **lævigata**, Terquem. Mém. Soc. Géol. France, [3], II, 1882, 151, xv (xxiii), 27–31.
——— **lineata**, Brady. Report Challenger, 1884, 183, xii, 19–21.
——— **multilocularis**, Brady, Parker, & Jones. Trans. Zool. Soc. XII, (7), 1888, 215, xl, 10.
——— **nitida**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 300, No. 1.
——— ——— ——— Modèles, 1826, No. 22.
——— ——— ——— Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829-43, 10, iii, 8 and 9.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls., 1837), 19, vi, 8.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 2, 1837, 1145, xlii, 29*a, b*.
——— ——— ——— Reuss in Geinitz, Grundr. Verstein. 1845–46, 684, xxiv, 90.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 247, xlii, 29 *a b*.
——— ——— ——— P. J. & B. [d'O., Modèles, 22], Ann. Mag. Nat. Hist. [3], XVI, 1865, 22, i, 2 [= *A. conico-articulata*].

ASSILINA irregularis, Carter. Cart., Annals Mag. Nat. Hist. [2], XI, 1853, 168, vii, 5 and 6 (7 and 8 ?).
——— ——— ——— Cart., Geol. Papers Western India, 1857, 540, xxiii, 5 and 6.
——— **minima**, de la Harpe. Palæontographica, xxx, 1883, Pal. Theil, 213, xxxv, (6), 35–42.
——— **nili**, de la Harpe. *Ibid.* xxx, 1883, Pal. Theil, 213, xxxv (6), 29–34.
——— **nitida**, d'Orbigny. Ann Sci. Nat. VII, 1826, 296, No. 4.
——— **obesa**, Carter. Annals Mag. Nat. Hist. [3], VIII, 1861, 368, xv, 2; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 58.
——— **planospira**, d'Archiac. Mém. Soc. Géol. France, [2], III, 1848, 417, ix, 17*a*.
——— **radiolata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 296, No. 5.
——— **spira**, deR. Jones, in Newton Quart. Journ. Geol. Soc. XLV, 1889, 332, xiv, 16 [*Nummulites*, 1826].
——— **undata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 296, No. 3.
? ——— Carter, Journ. Bombay Br. R. Asiatic Soc. v, (xviii), (1853), 132, ii, 7 and 8.
——— see *Porpitæ soluti*, etc.
ASSULINA, Bronn, 1853–56. Misprint for *Assilina.*
ASTACOLUS crepidulatus, Montfort. Conch. syst. I, 1808, 263, 66th genre [= *Cristellaria*].
ASTERIACITES patellaris, Schlotheim. Die Petrefactenkunde, Nachtrag, 1822, 71, xii, 6 [v. also *Orbitoides*].
ASTERIATITES. Schlotheim, 1813. Taschenbuch für ges. mineral. VII, 1813, 109 [quotes 3 species, *A. siderolites, A. spinosus, A. pentagonatus*] [cfr. *Asteriacites*].
ASTERIGERINA, d'Orbigny, 1839. Voyage Amér. Mérid. "Foraminifères," v, (5), 1839, 55.
——— **carinata**, d'Orb. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 118, v, 25; vi, 1 and 2; also in Spanish, 1840, 118, same pls. and figs.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, (5), 1885, 1058, lxxxvi, 56.
——— **dubia**, Terquem. Ess. Anim. Plage Dunkerque, (1), 1875, 36, v, 7*a*,*b* (and Mém. Soc. Dunkerquoise).
——— **ferussaci**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 408, No. 1339 [*Rosalia*, 1825].
——— **geometrica**, Terquem. Ess. Anim. Plage Dunkerque, (1), 1875, 36, v, 6*a*, *b* (and Mém. Soc Dunkerquoise).
——— **hieroglyphica**, Terquem. Mém. Soc. Géol. France, [3], I, 1878, 32, iii (viii), 5*a*–8.
? ——— **lancicula**, Schwager. Palæontographica, xxx, 1883, Pal. Theil, 127, xxviii (5), 7*a*–*d*.
——— **lobata**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 118, v, 19–21; also in Spanish, 1840, 119, same pl. and fig.
——— ——— ——— D'Orb., Foram. Fossiles Vienne, 1846, 204, xxi, 39–41.
——— **monticula**, d'Orb. Voyage Amér. Mérid. "Foraminifères," v, (5), 1839, 55, ii, 18–20.
——— **planorbis**, d'Orb. Foram. Fossiles Vienne, 1846, 205, xi, 1–3 [v. *Discorbina*].
——— ——— ——— Egger, Neues Jahrbuch, 1857, 281, xi, 8–10
——— ——— ——— Reuss' Model No. 47, 1865 (Catal. No. 67, 1861) [= *Discorbina rosacea*, d'Orb.].
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877. 26, pl., 57.
——— ——— ——— = *Discorb. rosacea* (d'Orb.) v. *Ammoniæ planorbes.*
——— **rhodiensis**, Terquem. Mém. Soc. Géol. France, [3], I, 1878, 31, iii (viii), 1*a*–4.
——— **rosacea**, d'Orb., 1847. Prodrome de Paléont. III, 1852, 158, No. 2952 [*Rotalia*, 1825].
——— **tarentina**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 272, xxii, 13 and 14.
——— Pictet, Traité de Paléont IV, 1846, 237, xii, 23.
ASTEROCYCLINA, Gümbel, 1868. Abh. k. bayer. Ak. Wiss. x, (2), 1868, 689. This subgenus of *Orbitoides* was proposed by Gümbel for the following forms: *A. stellata* (d'Archiac); *A. priabonensis*, Gümbel; *A. stella*, Gümbel.

ASTERODISCINA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1 [a family group name].

ASTERODISCUS, Ehrenberg, 1838. Abhandl. k. Ak. Wiss. Berlin, 1838, 130

——— **forskålii**, Ehrenb. *Ibid.* 1838, 130.

ASTERODISCUS, Schafhäutl, 1863. Sud-Bayerns Lethæa Geogn. 1863, 107.

——— **patellaris**, Schafhäutl. *Ibid.* 1863, 108, xv, 3*a*, *b*, *c* [*Hymenocyclus* in text].

——— **pentagonalis**, Schafhäutl. *Ibid.* 1863, 107, xv, 2*a–d*.

ASTIGERINA, Pictet, 1846. Misprint for *Asterigerina*.

ASTRIGERINA, Egger, 1857. Misprint for *Asterigerina*.

ASTRODISCUS, F. E. Schulze, 1875. II Jahresb. Comm. wiss. Untersuch. deutsch. Meer in Kiel, 1875, 113.

——— **arenaceus**, Schulze. *Ibid.* 1875, 113, ii, 10 [= ? *Astrorhiza*].

ASTRORHIZA, Sandahl, 1857. Ofversigt k. Vetens.-Ak. Förhandl. 1857 (1858), 299; Brady, Report Challenger, 1884, 230. [Haeckel, in his "Report of the Deep-sea Keratosa," Report Challenger, xxxii, 1889, 2, remarks, "I suppose that some of the gigantic foraminifera of the deep sea, which Mr. H. B. Brady has described in his Report as Astrorhizidæ (especially *Rhabdammina*, *Rhizammina*, *Sagenella*, etc.), may also belong to the arenaceous Keratosa (Ammoconidæ)."]

——— **angulosa**, Brady. Quart. Journ. Micro. Sci. xxi, 1881, 48. Brady, Report Challenger, 1884, 234, xx, 10–13.

——— **arenaria**, Norman. Proc. Roy. Soc. xxv, 1876, 213.

? ——— ——— [Carpenter]. Bütschli in Bronn. Klassen, etc., Thier-Reichs, 1880, 194, v, 12.

——— ——— ——— Brady, Report Challenger, 1884, 232, xix, 5–10.

——— **catenata**, Norman. Proc. Roy. Soc. xxv, 1876, 213 [= *Aschemonella*].

——— ——— ——— Brady, Q. Journ. Micr. Sci. xix, 1879, 42, iv, 12–13.

——— ——— ——— Moseley, Nature (Apr. 15, 1880), xxi, 570, f. 11*a*.

——— **crassatina**, Brady. Quart. Journ. Micr. Sci. xxi, 1881, 47.

——— ——— ——— Brady, Report Challenger, 1884, 233, xx, 1–9.

——— **cornuta**, Brady. Q. Journ. Micr. Sci. xix, 1879, 43, iv, 14, 15 [= *Rhabdammina*].

——— **granulosa**, Brady. *Ibid.* xxi, 1881, 48 [= *Marsipella*, 1879].

——— ——— ? ——— Haeusler, Neues Jahrbuch, 1883, i, 57, iii, 6.

——— ——— ——— Brady, Report Challenger, 1884, 234, xx, 14–23.

——— ——— ——— Neumayr, Stämme d. Thierreiches, i, 1889 (8), 173, f. 17*d*.

——— **limicola**, Sandahl. Ofversigt k. Vetens.-Ak. Förhandl. 1857 (1858), 299, iii, 5 and 6.

——— ——— ——— Leidy, Proc. Ac. Nat. Sci. Philad. 1875, 75, fig.

——— ——— ——— P. Fischer, Journ. Zoologie, iv, 1875, 505, xvi 1–4.

——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 194, v, 11.

——— ——— ——— Brady, Report Challenger, 1884, 231, xix, 1–4.

——— ——— ——— Agassiz, Three Cruises "Blake," ii, 1888, 161, f. 489.

——— Carpenter. Quart. Journ. Micr. Sci. xvi, 1876, 221, xix, 1–13.

ATAXOPHRAGMIUM, Reuss, 1861. Verz. Gypsmodellen Foraminiferen, [1861], Nos. 8 and 9. Genus founded upon d'Orbigny's *Bulimina variabilis*.

——— **arenaceum**, Karrer. Sitz. k. Ak. Wiss. Wien, lii, (1), 1865 (1866), 495, pl., 9.

——— **globulare**, Reuss. *Ibid.* l, (1), 1864 (1865), 449, i, 2.

——— **humile**, Karrer. In v. Drasche, Frag. Geol. Luzon, 1878, 85, v, 3 and Bol. Com. map Geol. Españ. vii, 1880, 267, *E*, 3.

——— **intermedium** (Reuss). Schwager, Boll. R. Com. Geol. Ital. viii, 1877, 26, pl., 89 [= *Bulimina*, 1845].

——— **laceratum**, Schwager. Novara-Exped. Geol. ii, 1866, 194, iv, 3*a*, *b*, *c*.

——— **magdalidiforme**, Schwager. *Ibid.* ii, 1866, 193, iv, 1 *a*, *b*, *c*.

——— **oblongum**, Reuss. Sitz. k. Ak. Wiss. Wien, lii, (1), 1865 (1866), 458, pl., 2.

——— **simile**, Karrer. *Ibid.* lviii, (1), 1868, 126, i, 1.

——— **suborale**, Schwager. Novara-Exped. Geol. ii, 1866, 193, iv, 2*a*, *b*, *c*.

——— **variabile** (d'Orbigny). Reuss' Models Nos. 6 and 7, 1865 (Catal. Nos. 8 and 9, 1861) [= *Bulimina*, 1840].

ATRACTOLINA, v. Schlicht. "Foram. Septar. Pietzpuhl," 1870, xxv, 1-10 [referred by Reuss to *Psecadium acuminatum* = *Glandulina* (Brady)].
ATRACTOSPIRA, de Folin, 1882. Congrès. Scient. Dax, 1882 (1883), 319.
AULOSTOMELLA, Alth, 1850. Haidinger's Nat. Abh. III, (2), 1850, 264 [founded on a fistulose var. of *Polymorphina sororia*, Reuss].
——— **dorsigera**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 281, xviii, 20, *a*, *A*, *B*.
——— **pediculus**, Alth. Haidinger's Nat. Abh. III, (2), 1850, 264, xiii, 17 [= *Polym. sororia*, Rss.].
AURICULINA, Costa, 1856. Atti Accad. Pontaniana, VII, (2), 1856, 259 [= *Pulvinulina* or *Discorbina*].
——— **crenata**, Costa. *Ibid.* VII, (2), 1856, 260, xxii, 15 and 16.
BALANULINA, Rzehak, 1888. Ann. k. k. nat. Hofmuseums, III, (3), 1888, 265.
——— **kittlii**, Rzehak. *Ibid.* III, (3), 1888, 265, xi, 8*a*, *b*.
BATHYSIPHON, M. Sars, 1871. G. O. Sars, Forh. Vidensk.-Selsk. Christiana, 1871 (1872), 251; Brady, Report Challenger, 1884, 248.
——— **capbritonensis**, de Folin. Actes Soc. Linn. Bordeaux, XL, (5), 1887, 274, v, 1*a–c*.
——— **capillare**, de Folin. *Ibid.* XL, (5), 1887, 276, v, 2*a–e*.
——— ——— ——— De Folin, Le Naturaliste, Ann. 9, 1887, 114, f. 7*b*.
——— **echinatum**, de Folin. Actes Soc. Linn. Bordeaux, XL, (5), 1887, 278, vi, 3*a–c*.
——— **filiformis**, M. Sars MS. G. O. Sars, Vidensk.-Selsk. Forhandl. 1871, 251.
——— ——— ——— Brady, Report Challenger, 1884, 248, xxvi, 15–20.
——— ——— ——— De Folin, Actes Soc. Linn. Bordeaux, XL, (5), 1887, 279, vi, 4*a–e*.
——— **flavidum**, de Folin. *Ibid.* XL, (5), 1887, 279, vi, 5*a–c*.
——— **major**, de Folin. *Ibid.* XL, (5), 1887, 280, vii, 6*a–d*.
——— **nitens**, de Folin. *Ibid.* XL, (5), 1887, 282, vi, 7*a–c*.
——— **rufum**, de Folin. *Ibid.* XL, (5), 1887, 283, vi, 8*a–c*.
——— **rusticum**, de Folin. *Ibid.* XL, (5), 1887, 284, viii, 9*a–c*.
——— **strictum**, de Folin. *Ibid.* XL, (5), 1887, 285, viii, 10*a*, *b*.
——— **subvitreum**, de Folin. *Ibid.* XL, (5), 1887, 286, viii, 11.
——— De Folin, Bull. Soc. N. H. Toulouse, XV, 1881, 138; five new sp. proposed but not described!
BDELLOIDINA, Carter, 1877. Carter, Ann. Mag. Nat. Hist. [4], XIX, 1877, 201; Brady, Report Challenger, 1884, 319.
——— **aggregata**, Carter. Ann. Mag. Nat. Hist. [4], XIX, 1877, 201, xiii, 1–8.
——— ——— ——— Brady, Report Challenger, 1884, 319, xxxvi, 4–6.
BEATRICEA. This genus, described by Billings in 1853 as a plant, has since been referred to as a mollusc, sponge, coral, etc. In 1884 Alpheus Hyatt stated that it showed foraminiferal structure and that he "himself now thought it a foraminifer (Science, Oct. 3, 1884). [The largest specimen seen by Billings was 10 ft. 5 in. long and 5-6 inches diameter.]
The more important references to it are the following:
——— Billings. Geol. Survey Canada, Report for 1853–56 (1857) 343.
——— Hyatt. Amer. Journ. Sci. XXXIX, 1865, 263.
——— ——— Proc. Amer. Assoc. Philadelphia, 1884, (1885), 492; Science, Oct. 3, 1884, 341 [both abstracts].
BIFARINA, Parker & Jones, 1872. Annals Mag. N. Hist. X, 1872, 198. A dimorphous *Virgulina* [" ? = *Otostomum*, Ehrenberg, Monatsber. k. pr. Ak. Wiss. Berlin, April, 1872, 276," Jones MS.].
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——— **globulosa**, Egger. Neues Jahrbuch, 1857, 296, xi, 4–7.
——— **inexculta**, Franzenau. Math. termész. értesitö, VII, 1889, 247, iv, 2.
——— **jonesiana**, Brady. Quart. Journ. Micros. Sci., n. s. XXI, 1881, 59 [= *Bulim. contraria* (Rss.), Brady, 1884].
——— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 282, (No. 1), xv [vi by error in text], 4 and 5.

CELLEPORA hemisphærica, Parfitt. Annals and Mag. Nat. Hist. [4], XII, 1873, 98, iii *B*, 1–6 [= *Gypsina inhærens* (Schultze), Brady].

CELLULINA besseri, Zborezewski. Nouv. Mém. Soc. Nat. Moscou, 1834, 308, xxvi, f. 2.

—— **eichwaldii**, Zborezewski. *Ibid.* 1834, 308, xxvi, f. 1.

—— **puschii**, Zborezewski. *Ibid.* f. 3 [= ? *Dactylopora*, P. & J., Annals Mag. N. H. (3), XII, 1863, 203].

CENCHRIDIUM, Ehrenberg, 1845. Bericht. k. preuss. Ak. Wiss. Berlin, 1845, 357 [= *Lagena*].

—— **aargovense**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 13, II, Opalinusthon 1 [= *Lag. globosa*, long var.].

—— **capense**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 281.

—— **dactylus**, Ehrenberg. Mikrogeologie, 1854, xxiv, 1 and 2 [= *Lag. emaciata?*, Reuss].

—— **globosum** (Will.). Stein, Organ. Infusionsthiere, III, (2), 1883, 18, ii, 1 and 2 [*Entosolenia*, 1858].

—— **incurvum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 281.

—— —— —— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 17.

—— **oliva**, Ehrenberg. Mikrogeologie, 1854, xxiv, 3 and 4, and xxxvii, vi, 1 [= *Lag. globosa*].

—— **rugulosum**, Stein. Organ. Infusionsthiere, III, (2), 1883, 18, ii, 5.

—— **sphærula**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 368.

—— —— —— Stein, Organ. Infusionsthiere, III, (2), 1883, 18, ii, 3 and 4.

—— **tridactylum**, Stein. *Ibid.* III, (2), 1883, 18, ii, 6.

CENCHRITES, Mercatus. Metallotheca, 1719, 285, f., and 286, f. [= *Nummulites*].

CEPINULINA oblonga, Schafhäutl. Geogn. Unters. sudbayer. Alpengeb. 1851, 49, xiii [misprinted in text xviii], f. 20 [an "oolitic granule;" may be *Miliola*.]

CERATESTINA, Carter, 1880. Ann. Mag. Nat. Hist. [5], v, 1880, 448; v. Brady, Report Foram. Challenger, 1884, p. 77 [one of the Testamœbiformiæ].

—— **globularis**, Carter. *Ibid.* [5], v, 1880, 449, xix, *6a–g*.

—— **tessellata**, Carter. *Ibid.* [5], v, 1880, 450, xix, *7a–h*.

CERATOSPIRULINA, Ehrenberg, 1858. Monatsbericht k. pr. Ak. Wiss. Berlin, 1858, 11. [Characteres Quinqueloculinæ, sed ætate provecta in tubuli recti simplicis formam excrescentes. Quinqueloculinam longe tubulosam rostratam æquat.]

—— **sprattii**, Ehrenberg. *Ibid.* 1858, 19.

CERATOSPYRIS sprattii, Ehrenberg. Abh k. Ak. Wiss. Berlin, 1872 (1873), xi, 7 [= *Miliolina* with final chamber produced].

CERIOPORA globulus, Reuss. Haidinger's Nat. Abh. II, 1847, 33, v, 7 [= *Gypsina*].

CHÆTOTROCHUS hochstetteri, Ehrenberg. Novara-Exped. II, 1866, 76 and 81, not described.

CHARYBS plicatus, Montfort. Conch. Syst. I, 1808, 107, 27th Genre [= *Serpula*].

CHEIRAMINA, de Folin, 1881. Bull. Soc. N. H. Toulouse, xv, 132, not described; ten species proposed with the generic name of *Cheiropsis!*

CHEIROPSIS, de Folin, 1881. *Ibid.* xv, 132 [v. *Cheiramina*].

CHILOSTOMELLA, Reuss, 1849. Denkschr. k. Ak. Wiss. Wien, I, 1850, 379; Brady, Report Challenger, 1884, 436.

—— **cyclostoma**, Rzehak. Ann. k. k. nat. Hofmuseums, III, (3), 1888, 258, xi, *1a, b, c*.

—— **cylindroides**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 80, vi, 43.

—— —— —— Bornemann, *Ibid.* VII, 1855, 343, xvii, 1

—— —— —— Hantken. Magy. kir. földt. int. évkönyve, IV, 1875 (1876), 54, vii, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 63, same pl. and fig. [*C. cylindrica*, Rss. in descr. of plate].

—— [**cylindrops**], —— Pictet, Traité de Paléont. ed. 2, IV, 1857, 520, cix, 40.

—— **czizeki**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 380, xlviii, 13.

CLAVULINA angularis, d'Orb. Ann. Sci. Nat. VII, 1826, 268, No. 2, xii, 7.
——— ——— ——— Reuss in Geinitz, Grundr. Verstein. 1845–46, 667, xxiv, 66.
——— ——— ——— Brady, Report Challenger, 1884, 396, xlviii, 22–24.
——— ——— ——— var. **difformis**, Brady. *Ibid.* 1884, 396, xlviii, 25–31.
——— **antipodum**, Stache. Novara-Exped. Geol. (I), 1864, 167, xxi, 3–8.
——— **caperata**, Brady. Quart. Journ. Micros. Soc. XXI, 1881, 54 [= *Tritaxia*, 1884, q. v.].
——— **clavulus** (?), (Lam.). P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 154, ix, 32 [*Nodosaria*, 1816].
——— **communis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 268, No. 4 [v. *Verneuilina*].
——— ——— ——— D'Orb., Foram. Fossiles Vienne, 1846, 196, xii, 1, 2.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, 270, xxiii, 2.
——— [———] ———, Pictet, Traité de Paléont. ed. 2, IV, 1857, 514, cix, 33.
——— ——— ——— Reuss' Model No. 98, 1865 (Catal. No. 10, 1861).
——— ——— ——— Zittel, Handbuch Palæont. (1), 1876, 90, f. 27⁵.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 90.
——— ——— ——— Brady, Report Challenger, 1884, 394, xlviii, 1–13.
——— ——— ——— var. **irregularis**, Costa. Fornasini, Boll. Soc. Geol. Ital. II, 1883, 184, ii, 3 [v. *C. irregularis*].
——— ——— ——— Fornasini, *Ibid.* IV, 1885 (1886), 106, vi, 1 and 2.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 743, xv, 1.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII (7), 1888, 220, xlii, 11.
——— **corrugata**, Deshayes. In Lyell, Principles of Geology, III, 1833, 251, iv, 12–14.
——— ——— ——— Brown, Elem. Foss. Conch. 1843, 25, ii, 43 and 44.
——— **cylindrica**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 268, No. 1.
——— **cylindrica**, Hantken. Magy. kir. földt. int. évkönyve, IV, 1875 (1876), 14, i, 8; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 18, same pl. and fig.
——— ——— ——— Hantken, Kohlenflötze, etc., ungar. Krone, 1878 (transl. from Magyar), 227, f. 42.
——— ——— ——— Brady, Report Challenger, 1884, 396, xlviii, 32–38.
——— ——— ——— Karrer, Abh. k. k. Geol. Reichs. IX, 1877, 373, xvi*a*, 4.
——— **elegans**, Karrer. Novara-Exped. Geol. (1), 1864, 80, xvi, 11.
——— **eocæna**, Gümbel. Abh. m.-ph. Cl. k.-bayer Ak. Wiss. X, 1868 (1870), 601, i, 2*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. Géol. France [3], II, 1882, 121, xii, (xx), 35*a*. *b*.
——— **gaudryinoides**, Fornasini. Boll. Soc. Geol. Ital. IV, 1885 (1886), 106, vi, 3–9.
——— **indiscreta**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 55 [= *Tritaxia*, 1884, q v.].
——— **irregularis**, v. Münster. In Rœmer, Neues Jahrbuch, 1838, 387, iii, 40.
——— **irregularis**. Costa. Atti Accad. Pontaniana, VII, (2), 1856, 270, xxi, 4, 5 and 6 [error for xxii, 1–3].
——— **nodosaria**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 110, ii, 19 and 20, also in Spanish, 1840, 113, same pl. and fig.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, (5), (1885), 1058, lxxxvi, 54.
——— **parisiensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 268, No. 3.
——— ——— ——— D'Orb., Modèles, No. 66, 1826.
——— ——— ——— P., J. & B. [d'O., Modèles, 66], Ann. Mag. Nat. Hist. [3], XVI, 1865, 29, i. 26 [= *Valvulina*].
——— ——— ——— Terquem, Mém. Soc Géol. France, [3], II, 1882, 121, xii (xx), 34*a*, *b*.
——— ——— ——— Schwager, Palæontographica, XXX, 1883, Pal. Theil, 116, xxvi (3), 18*a*–*c*.
——— (**Valvul.**) ——— Jones, in Microgr. Dict. ed. 4, 1883, 182, xxiii, 51.
——— ——— ——— Brady, Report Challenger, 1884, 395, xlviii, 14–18.
——— ——— ——— var. **humilis**, Brady. *Ibid.* 1884, 395, xlviii, 19–21.

CONCHULA minima, Littoris Ariminensis arcte in se contorta, albissima, lævissimaque, extrinsecus Concham Veneream referens, Plancus. *Ibid.* 19, II, f. i *A–C* [= *Miliolina*].

CONODICTYUM striatum, Münst. Gümbel, Sitz. k.-bayer. Ak. Wiss. München, III, 1873, 294, i, 16–24. [A genus of calcareous algæ.]

CONULINA, d'Orbigny, 1839. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, 24.

—— **conica,** d'Orbigny. *Ibid.* 1839, "Foraminifères," 24, i, 15 and 16; also in Spanish, 1840, 52, same pl. and fig.

—— —— —— D'Orb., Foram. Fossiles Vienne, 1846, 71, xxi, 7, 8.

—— —— —— Bronn, Lethæa Geognostica, ed. 3, II, 1851–52, 90, xxix[1], 26.

—— —— —— Reuss' Model No. 71, 1865 (Catal. No. 13, 1861).

—— **irregularis,** d'Orbigny, 1847. Prodrome de Paléont. II, 1850, 210, No. 356.

CONULITES, Carter, 1861. Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 53 [= *Patellina*].

—— **cooki,** Carter. *Ibid.* VI, 1861 (1862), 83; Annals Mag. N. Hist. [3], VIII, 457, xv, 7.

—— —— —— Schwager, Boll. R. Com. Geol. Ital. VIII 1877, 26, pl., 75.

COPROLITHEN, Philippi. Tertiar. nordwest. Deutsch. 1843, 63, iv, 27*a*, 27*a* (2), 28 [27 (2) = *Lituola*; 28 = *Chara* ?].

CORNE d'ammon, d'Argenville. Conchyliologie, 1780, I, 680, vii, *B* 1 [= 2]; and 731, lxix, *D*1 [*Rotalia Beccarii*].

CORNO d'ammone, Targioni. Relaz. d'alc. viaggi, ed. 2, IV, 1770, 13, i, figs. 17–19; 21–36 [= ? *Rotalia Beccarii*].

CORNU ammonis ariminiense, Planc. Parkinson, Introd. Study Foss. Organ. Rem. 1822, 169, vi, 19 [= *Rotalia Beccarii*].

—— **ammonis erectum vulgare, striatum, siliquam raphanistri perfectissime referens,** Klein. Vers. u. Abh. Nat. Ges. Dantzig, II, 1754, 1, etc., i, f. 1 *A*, *B* [= *Nodos. raphanistrum*].

—— **ammonis,** etc., Ledermüller. Mikr. Gemüths, 1763, 16, viii [*Rotalia*, *Cristellaria*, *Vaginulina*, *Nodosaria*, *Glandulina*, etc.].

—— **hammonis,** Klein. Methodi Ostracolog. 1753, 4, i, 6–9 [6 and 7 are not Foraminifera; 8 and 9 = ? *Cornuspira*].

—— **hammonis . . . . ad Lituum accedens,** Martini. See *Peneroplis*, Martini.

—— —— **depressum in eodem Littore [Liburni] repertum, quod umbilicatum est umbilico scilicet concavo . . .** F. Colonna, 1744, *ΦΥΤΟΒΑΣΑΝΟΝ*, appendix, xxxviii, *E* [= *Peneropl. planatus*].

—— —— —— **Littoris Liburnensis Umbilico concavo,** Plancus. De Conch. min. not. 1760, 95, i, f. *X*, *P* [= *Peneroplis*].

—— —— **Littoris ariminensis,** Ginanni. Opera postume, 1755, 20, xiv, [= *Rotalia* and *Cristellariæ*].

—— —— —— —— **erectrum depressum striatum, vaginulam glandii referens,** Plancus. De Conch. min. not. 1739 (Rome, 1760), 16, i, vii, *G–I* [= *Vag. legumen*].

—— —— —— —— **erectum globosius,** Plancus. *Ibid.* 16, ii, iii, *D–F* [= *Glandulina*].

—— —— —— —— **erectum minus vulgare lævissimum, siliquam Radiculæ perfectissimi referens,** Plancus. *Ibid.* 14, i, v, *A–C* [= *N. radicula*].

—— —— —— —— **erectum vulgare, striatum, siliquam, Raphanistri perfectissime referens,** Plancus. *Ibid.* 15, i, vi, *D* to *H* [= *N. raphanus* and *N. raphanistrum*].

—— —— —— —— **minus vulgare Orbiculatum striatum, umbilico prominente, ex quo striæ et loculamenta omnia prodeunt,** Plancus. *Ibid.* 10, i, ii, *E* and *F* [= *Polystomella*].

—— —— —— —— **Quartum, seu Nautili genus valde depressum umbilico carens et plerumque marginatum,** Plancus. *Ibid.* 13, i, iv, *N* and *M* [= ? *Cristellaria*].

—— —— —— —— **Tertium, seu Nautili genus umbilico prominente et plerumque marginatum,** Plancus. *Ibid.* 12, i, iii, *H* and *I* [= *Crist. rotulata*].

—— —— —— —— **Tertium,** etc., Plancus, q. v. Figures xii and xiii of Pl. i in the De Conch. min. not., ed. 1760, are referred by Plancus to this form. [They = *C. cultrata.*]

CORNUSPIRA foliacea (Phil.). Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 189, iv, 8 and viii, 1.
——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 120, ix, 308, 310.
——— ——— ——— Jones in Micrógr. Dict. ed. 4, 1883, 210, xxiii, 13.
——— ——— ——— Brady, Report Challenger, 1884, 199, xi, 5–9.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. xxviii (Sci.), 1885, 326, xii, 1*a*, 1*b*.
——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 161, f. 488.
——— **gracilis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 17, ii, Parkinsonthon, 4 [= *Trochamm. incerta*].
——— **granulosa**, Terquem. Mem. Ac. Imp. Metz, LI, 1870, 344, xxv, 12*a*, *b*.
——— **helvetica**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 13, ii, Opalinusthon 3 [= *Spirillina*].
——— **hörnesi**, Karrer. Sitz. k. Ak. Wiss. Wien, LII, (1), 1865 (1866), 495, pl., 10.
——— **infima** (Strickl.). Tate & Blake, Yorkshire Lias, 1876, 451, xviii, 1 [v. *Orbis*, 1846].
——— **infraoolithica**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 345, xxv, 13.
——— **intermedia**, Gümbel. Sitz. k.-bay. Ak. Wiss. III, 1873, 39, no fig.
——— **involvens**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (I), 1863 (1864), 39, i, 2 [*Operculina*, 1849].
——— ——— ——— Reuss' Model No. 9, 1865 (Catal. No. 15, 1861).
——— ——— ——— J., P. & B., Crag Foram. Pal. Soc. XIX, 1866, 3, iii, 52–54.
——— ——— ——— Hantken, Magy. kir. földt. int. evkönyve, IV, 1875 (1876), 16, ii, 2; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 19, same pl. and fig.
——— ——— ——— Brady, Report Challenger, 1884, 200, xi, 1–3.
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 23, i, 1.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII, (Sci.), 1885, 327, xii, 2*a*, 2*b*.
——— ——— ——— Burbach, Zeitschr. Naturw. Halle, LIX, 1886, 497, v, 1.
——— ——— ——— Anon. Sci. News, 27 April, 1888, 389, f. 7.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 216, xl, 1–3.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 484, xi, 4, 5.
——— **lacunosa**, Brady. Report Challenger, 1884, 202, cxiii, 21.
——— **latior**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 33, iv, Impressathon, 3 [= *Troch. incerta*].
——— **liasina**, Terquem. Sixième Mém. Foram. Lias, 1866, 474, xix, 4*a*, *b*.
——— **marginata**, M. Sars. Vidensk.-Selsk. Forhandl. 1868, 249 [referred to *C. carinata* by Brady. 1884].
——— **media**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 33, iv, Impressathon 2 [= *Troch. incerta*].
——— **numismalis** (Terq. & Berth.). Burbach, Zeitschr. Naturw. Halle, LIX, 1886, 498, v, 2 [*Spirillina*, 1875].
——— **nummulitica**, Gümbel. Abh. m.-ph. Cl. k.-bayer Ak. Wiss. X, 1868 (1870), 604, i, 5*a*, *b*.
——— **occlusa**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 346, xxv, 19, 20 [error for 18, 19].
——— **olygogyra**, Hantken. Magy. kir. földt. int. évkönyve, IV, 1875 (1876), 16, i, 10; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 20, same pl. and fig. [*C. oligogyra* on plate].
——— **oolithica**, Schwager. Benecke's Geogn.-Pal. Beiträge, I, 1868, 655, xxxiv, 4.
——— **orbicula** (Terq. & Berth.). Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [16], ii, 4 [*Spirillina*, 1875].
——— **pachygyra**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 178, v, 9 and 10.
——— **perforata**, Schultze. Organismus Polythal. 1854, 41, ii, 22 [v. *Spirillina*].
——— **planorbis**, Schultze. *Ibid.* 1854, 40, ii, 21.
——— ——— ——— Bronn. Klassen Ordn. Thier-Reichs, I, 1859, 69 vi, 1.
——— **polygyra**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 39, i, 1*a*, *b*.

COSC NOSPIRA, Ehrenberg, 1838.
——— **forskalii**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 131.
hemprichii, Ehrenberg. *Ibid.* 1838, 131, ii, ii; and three varieties, *α. lenticularis; β. bacillaris; γ. compressa* [= *Peneroplis*, see Carpenter, "Introduction," etc.].
——— **nautiloides**, Ehrenberg. *Ibid.* 1838, 131.
——— ——— ——— Reuss in Geinitz, Grundr. Verstein. 1845–46, 650, xxiv, 38, 39.
——— **savignyi**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 131.
COSCINOSPHÆRA ciliosa, Stuart. Zeitschr. wiss. Zool. XVI, 1866, 328, xviii, 1–4. [*Globigerina*, fide Haeckel, Greeff & Brandt] [see *Globig. echinoides*].
COSKINOLINA, Stache, 1875. Verh. k. k. geol. Reichs. 1875. 335, no fig. or descr. and Verh. 1880, 201, no fig. (*C. liburnica*), "eine Mittelform zwischen *Conulina conica*, d'Orb. und *Lituola nautiloidea*." [A plate was printed but not published; there is a copy in Mr. Brady's collection now in library of the Royal Society.]
——— Stache. Schwager. Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 86.
CREPIDULINA astacolus, de Blainville. Dict. Sci. Nat. XIX, 1821, 8; XXXII, 1824, 188; Atlas, Conch. XIX, 8 [= *Astacolus* of Montfort = *Crist. crepidula*].
——— ——— ——— Blain., Manuel Malac. et Conch. 1825 (pls. 1827), 383, x. 8.
CRIBROSPIRA, v. Möller, 1878. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXV, No. 9, 1878, 86.
——— **Panderi**, v. Möller. *Ibid.* [7], XXV, No. 9, 1878, 87, IV, 1*a–c*; X, 1*a*, *b*.
——— ——— ——— v. Möller, *Ibid.* [7], XXVII, No. 5, 1879, 11, [f. 2].
——— ——— ——— Roemer, Lethæa Geognostica, I, (1), 1880, 280, f. 48.
——— ——— ——— Hoernes, Elem. Palæont. 1884, 30, f. 22; French ed. 1886, same fig.
CRIBROSTOMUM, v. Möller, 1879. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 39. [The species of this genus are referred by Brady (Report Challenger, 1884) to *Textularia* and *Bigenerina*.]
——— **Bradyi**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 53, iii, 1*a–e*; VI, 1; 54, f. 18 and 19.
——— **commune**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879. 42, f. 11; 48, f. 15; 60, iii, 3*a–d*; VI, 4; 61, f. 24; 62, f. 25 and 26 [*Textularia*, Brady].
——— ——— ——— Hoernes, Elem. Palæont. 1884, 33, f. 27; French ed. 1886, same fig.
——— **elegans**, v. Möller. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 50, f. 17; 64, IV, 2; 3*a*, *b*, 4 and 5; 64, f. 28 [*Textularia*, Brady].
——— **eximium**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 46, f. 12; 47, f. 13 and 14; 55, IV, 1*a–e*; VI, 2; 56, f. 20 [*Textularia*, Brady].
——— **gracile**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 59, iii, 4; 60, f. 23.
——— **patulum**, (Brady). v. Möller, *Ibid.* [7], XXVII, No. 5, 1879, 57, iii, 2*a*, *b*; vi, 3; 58, f. 21 and 22 [*Bigenerina*, Brady].
——— **pyriforme**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 65, iv, 6*a*, *b*; 66, f. 29 [*Bigenerina*, Brady].
——— **textulariforme**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 41, f. 10; 49, f. 16; 62, iii, 5*a–c*; vi, 5; 63, f. 27.
CRISTALLARIA, Hantken, 1875. Misprint for *Cristellaria*.
CRISTELLARIA, Lamarck, 1812. Extract Cours Zool. 1812, 122; and Ency. Méthod., "Vers," II, (1830). 29. Parker & Jones give the date of the foundation of the genus as 1816; Brady, Report Challenger, 1884, 534.
——— **aargovensis**.
——— [**argovensis**], Kübler & Zwingli. Neujahrsblatt Burgersbibl. 1866, 9, i, 12.
——— ——— ——— Zwingli & Kübler, Foraminif. schweiz. Jura, 1870, 6, i, Turnerithon 15.
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——— ——— ——— var. **ovata**, Terquem. *Ibid.* (3), 1881, 117, xiii, 24*a*, *b*; (and Mém. Soc. Dunkerquoise).

CRISTELLARIA aculeata, d'Orbigny. Ann. Sci. Nat. VII, 1826, 292, No. 14.
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——— **acuminata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 420, x, 5*a*, *b*.
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——— **acuta**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 446, vi, 3*a*, *b*, *c*.
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——— ——— (**C. auricularis**), ——— Lamarck, Ency. Méthod. "Vers," II (1830), 32, 467, f. 7 (pls., 1827), (P. & J. quote 1816).
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——— **æquilata**, Reuss. Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 462, ii, 13*a*, *b*.
——— **æquilateralis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 27, iii, 29.
——— **ala**, Zwingli & Kübler. *Ibid.* 1870, 20, ii, Macrocephalus oolith, 8.
——— **alata**, Gümbel. Jahresh Ver. vat. Nat. Württ. XVIII, 1862, 226, iv, 1*a*, *b*.
——— **alata**, Terq. & Berth. Mém. Soc. Géol. France, [2], x, 1875, 43, iii (xiii), 16.
——— **alberti**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 133, vi, 20.
——— (**Rob.**) **alberti**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 209, ix, 24.
——— **alta**, Ehrenberg. Mikrogeologie, 1854, XXXII, ii, 37 [= *C. cultrata*].
——— **amæna**, Terquem. Cinquième Mém. Foram. Lias, 1866, 439, xviii, 7*a*, *b*.
——— **ammonoides**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. 1866, 14, ii, 21.
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——— **anglica**, Ehrenberg. Mikrogeologie, 1854, xxviii, 55 [= *Cr. cultrata*].
——— **angulata**, Reuss, v. **carinata**, Rzehak. Vert. nat. Ver. Brünn, XXIV, 1885 (1886), 107, i, 15 [*Robulina angulata*, 1851].
——— **angusta**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 32, ii, 7.
——— **anomala**, Terquem. Mém. Ac. Imp. Metz, L, 1870, 439, xiii, 26–30.
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——— **antiquata**, d'Orbigny, 1849. Prodrome de Paléont. I, 1849. 242, No. 265.
——— ——— ——— Terquem, Mém. Ac. Imp. Metz, XXXIX, 1858, 620, iii, 15*a*, *b*; and iv, 5.
——— **arcuata**, d'Orbigny. Foram. Fossiles Vienne, v, 1846, 87, iii, 34–36.
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——— ——— ——— Neugeboren Arch. Ver. siebenburg, Landeskunde N. F. X, (2), 1872, 276, i, 3 and 4.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 45, v, 5 and 6; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 53, same pl. and fig.

CRISTELLARIA arcuata, d'Orb. Jones, M. Micr. Journ. xv, 1876, cxxviii, *9a, b* and 20 *a, b; 21a, b*.
—— **arcuata** (Phil.). D'Orb., Prodrome de Paléont. III, 1852, 154, No. 2853 [*Marginulina*, 1844].
—— —— —— Reuss, Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 463, ii, 9–11.
—— —— —— v. **arguta**, Rss. Hantken, Magyar. Földt. Társ. Munkálatai, IV, 1868, 92, ii, 26*a, b, c* [*C. arguta*, 1856].
—— —— —— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 43, v, 10, xvi, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 51, same pl. and fig.
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—— —— —— Hantken, Kohlenflötze, etc., ungar. Krone, 1878 (transl. from Magyar), 221, f. 50.
—— **arcuata** (Karst.). Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1855, 233, iii, 34–36 [*Planularia*, 1849].
—— (**Robul.**) **arcuato-striato**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 93, ii, 30*a, b, c*.
—— **argovensis**, v. *C. aargovensis*.
—— **arguta**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 235, iii, 37.
—— **arietis**, Terquem. Sixième Mém. Foram. Lias, 1866, 510, xxi, 30.
—— (**Rob.**) **ariminensis**, d'Orbigny. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 199, viii, 10 [*Robulina*, 1826].
—— **armaschewskii**, Toutkowsky. Zap. Kievsk. Obsch. Est. IX, 1888, 32, iii, 2*a, b, c*.
—— **articulata**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, 1870, 483; v. Schlicht, Foram. Pietzpuhl, 1870, xvii, f. 5–12 [v. *Robulina*, 1863].
—— —— —— Brady, Report Challenger, 1884, 547, lxix, 1–4, 10–12.
—— **articulata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 140; xiii, 10, 10*a*.
—— **articulata**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 447, vi, 6*a, b*.
—— **aspera**, Alth. Haidinger's Naturw. Abh. III, (2), 1850, 268, xiii, 24.
—— **asperula**, Gümbel. Abh. m.-ph. Cl. k. bayer. Ak. Wiss. X, 1868 (1870), n. d., i, 65*a, b*.
—— **attenuata**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 28, iii, 32.
—— **aureola**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 383, xvi*b*, 39.
—— **auricula** (v. M.) Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 235, iii, 38 [v. *Planularia*, 1838].
—— **auriformis**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 153, viii, 4.
—— **auris** (d'Orb.), 1847. D'Orbigny, Prodrome de Paléont. III, 1852, 192, No. 509 [*Planularia*, 1826].
—— **auris**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 22, ii, Ornatenthon 4.
—— **auris** (Defr.). See *Planularia* and *Orthoceras*.
—— **austriaca**, Terquem. Essai Anim. Plage Dunkerque, (2), 1876, 70, vii, 20*a, b* (and Mém. Soc. Dunkerquoise).
—— **baccularis**, Terquem. Sixième Mém. Foram. Lias, 1866, 514, xxii, 2*a, b*, 3*a, b*.
—— **badensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 34, iv, Impressathon 11.
—— **baylei**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 336, vii, 7.
—— **behmi**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 138, ii, 37 [v. also *Marginulina*].
—— (**Marg.**) —— —— Hantken, Magyar. Földt. Társ. Munkálatai, IV, 1868, 91, ii, 21*a, b*.
—— **berthelotiana**, d'Orbigny. Barker, Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, (2), "Foraminifères," 127, i, 12 and 13 [error for 14 and 15].
—— **beyrichi** (Born.), Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 148, iii, 20 [*Robulina*, 1855].
—— **biclivosa**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 133, vi, 21.
—— **bicornis**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 192, xvi, 3*a, A, B* [error for xvii, 1 and 3].

CRISTELLARIA calcar (Linné), var. Terquem, Ess. Anim. Plage Dunkerque, (3), 1881, 117, xiii, 22*a*, *b* (and Mém. Soc. Dunkerquoise).
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——— ——— ——— Soldani, Testac. 1789, I, (1), 54, pl. 33, *C*, *E*, *aa*, *bb*, *mm*, *nn*, = this form. See also *Nautili diversæ speciei*.
——— ——— see *Naut. dentati* and *Naut. echinati* and *Naut. circumradiati*.
——— ——— v. *Antenor*.
——— ——— v. *Clisiphontes; Rhinocurus*.
——— ——— v. *Pharamum*.
——— ——— v. *Nautilus*.
——— **caleata**, Schwager. Novara-Exped. Geol. II, 1866, 244, vii, 88.
——— **caligula**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 39, iv, Badener Schicht, 9.
——— **callifera**, Stache. Novara-Exped. Geol. I, 1864, 236, xxiii, 15*a*, *b*.
——— **candonensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 292, No. 18.
——— **carantiana**, d'Orbigny, 1847. Prodrome de Paléont. II, 1850, 185, No. 752.
——— **carinata** (d'O). P., J. & Brady, [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 178, x, 83 [v. *Soldania*, 1826].
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——— **carinato-costata**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, (1), 1884, 43, ii, 5, 5*a*.
——— **cassiana**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 177, v, 2 and 3.
——— **cassidata**, Montf. See *Linthuris*.
——— **cassis** (Fichtel & Moll). D'Orbigny, Modèles, No. 83, and young No. 44, 1826 [v. *Nautilus*, 1798].
——— ——— ——— Lamarck (*C. papillosa*), Ency. Méthod. "Vers," II, (1830), 29, (pls. 1827), (P. & J. quote 1816), 467, f. 3 *a–d*.
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——— ——— ——— P., J. & B. [Soldani], *ibid.* [4], VIII, 1871, 244, x, 87 [see *C. soldanii*, d'O.].
——— ——— ——— (feeble). P., J. & B. [Soldani], *ibid.* [4], VIII, 1871, 244, x, 88 [see *C. nitida*, d'O.].
——— ——— ——— (young), P., J. & B. [Soldani], *ibid.* [4], VIII, 1871, 240, x, 89 [see *Robulina marginata*, d'O.].
——— ——— [Lam.], var. Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F., x, (2), 1872, 278, i, 17 and 18.
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 15.
——— ——— [Lam.], var. Seguenza, Atti. Acc Lincei, [3], VI, 1880, 141, xiii, 14.
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CRISTELLARIA compressiuscula, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. III, 1852, 154, No. 2852 (= *Marginulina*, Philippi, 1844).

——— **comptula**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 133, vi, 19.

——— **concinna**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 148, iv, 3.

——— **conferta**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 50, iv, 46*a*, *b*.

——— **conglomeratica**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 299, vi, 9.

——— **consecta**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 290, No. 1.

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——— **contracta**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 121, i, 5, *A*, *B*.

——— **contracta**, Terquem. Cinquième Mém. Foram. Lias, 1866, 440 xviii, 9*a*, *b*.

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——— **convergens**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 327, xiii, 16 and 17.

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——— **convexa**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 34, iv, Impressathon 10.

——— **convoluta**, Bornemann. Lias von Göttingen, 1854, 42, iv, 38*a*, *b*.

——— **cordiformis**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 413, ix, 14*a*, *b*.

——— **cornucopiæ**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 121, v, 7.

——— **costata** (Fichtel & Moll). Brady, Report Challenger, 1884, 555, lxxi, 8 and 9. [See *Nautilus*, 1798, and *Nautili diversæ speciei.*]

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——— **crassa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 90, iv, 1–3.

——— ——— ——— Zwingli & Kübler, Foraminif. schweiz. Jura, 1870, 34, iv, Impressathon 9.

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——— (**Marg.**) **crassicosta**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 177, ii, 8.

——— **crepidula** (Fichtel & Moll). D'Orbigny, De la Sagra, Hist. Phisiq. etc., Cuba, 1839, "Foraminifères," 41, viii, 17 and 18; also in Spanish, 1840, 64, same pl. and fig. [v. *Nautilus*, 1798].

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CRISTELLARIA decorata, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 269, viii, 16; ix, 1 and 2.
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——— **deformis**, Bornemann. Lias von Göttingen, 1854, 41, iv, 35*a*, *b*.
——— **deformis**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, (1), 1867, 349, i, 3.
——— **deformis**, Reuss. Hantken, Magyar. Földt. Társ. Munkálatai, IV, 1868, 93, ii, 23*a*, *b* [v. *Robulina*, 1851].
——— **dentaliniformis**, Terq. & Berth. Mém. Soc. Géol. France, [2], x, 1875, 43, iii (xiii), 19*a–c*.
——— **dentata**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, (1), 1867, 348, i, 1.
——— ——— ——— Brady, Report Challenger, 1884, 540, cxiii, 12*a*, *b*.
——— ——— ——— Rzehak, Vert. nat. Ver. Brünn, XXIV, 1885 (1886), 108, i, 14 ("*a* = *C. lanceolata*, d'Orb.; *b* = *C. semiluna*, d'Orb.").
——— **denticulata**, Rss. Verstein. Böhm. Kreide, 1845–6, I, 33, viii, 12.
——— **depauperata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 66, vi, 67, 68; viii, 90*a*, *b*.
——— ——— ——— var. **costata**. Reuss, Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 146, iii, 19; iv, 5, 6.
——— ——— ——— var. **intumescens**. *Ibid.* XXV, 1865, 146, iv, 2, 4.
——— **deperdita**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 423, x, 10*a*, *b*.
——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 292, No. 8.
——— **desorii**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 28, iii, 30.
——— **dewalquei**, Reuss. Bull. Ac. Roy. Belg. [2], xv, 1863, 149, ii, 22, 23.
——— **diademata**, Berthelin. Mém. Soc. Géol. France, [3], I, 1880, 51, iii (xxvi), 4*a*–5*b*, 12 and 13.
——— **dictyodes**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, (1), 1884, 48, ii, 9, 9*a*.
——— **dilatata** Lam. Ency. Méthod. "Vers," (pls. 1827), II, (1832), 29, 467, f. 1 and 2 [=*Penerop. planatus*, F. & M.].
——— **dilecta**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 71, vii, 12*a*, *b*.
——— **dilutestriata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 639, i, 69.
——— **dimorpha**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 148, iii, 16.
——— **dimorpha**, Toutkowsky. Zap. Kievsk. Obsch. Est. IX, 1888, 26, IV, 1, 2, 3.
——— **disco-granulata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 141, xiii, 15.
——— **doliolum**, Terquem. Mém. Ac. Imp. Metz, L, 1870, 431, ix, 29*a*, *b*.
——— **dubiensis**, Berthelin. Mém. Soc. Géol. France, [3], I, 1880, 52, iii (xxvi), 24*a*, *b*.
——— **dunkeri**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 73, viii, 6*a*, *b*.
——— **duracina**, Stache. Novara-Exped. Geol. I, 1864, 237, xxiii, 16*a*, *b*.
——— (**Robulina**) **echinata**, d'Orbigny. Carpenter, Parker & Jones, Introd. Foram. 1862, xii, 3 [v. *Robulina*, 1846].
——— (**Rob.**) ——— Nicholson, Manuel Palæont. 1879, I, 101, f. 15.
——— (**Rob.**) ——— [(Sold.)]. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 199, vii, 27.
——— ——— ——— Brady, Report Challenger, 1884, 554, lxxi, 1–3.
——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 293, No. 24.
——— ——— ——— v. *Lituus elegans*, Soldani.
——— **elegans**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 43, xiv, 4; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 88, same pl. and fig.
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——— **margulinoides**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 27, iii, 26 [? *marginulinoides*].
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——— **minuta**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 43, xiv, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 50, same pl. and fig.
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——— **ornata**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 623, iv, 1*a–c*.
——— **ornata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 77, xiii, 19; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 54, same pl. and fig.
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——— **papilionacea** (**C. lævis**), Lamarck. Ency. Méthod. "Vers," II (1830), 29, 467, f. 4, *c*, *d* (pls. 1827); (P. & J. quote "pt. 23, 1816").
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——— **parallela**, Terquem. Mém. Ac. Imp. Metz, L, 1870, 430, ix, 27*a*, *b*.
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——— **parkinsoni**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 18, ii, Parkinsonthon 9.
——— **partschi**, Michelotti. Nat. Verh. Holland Maatsch. Wetensch. Haarlem, II Verzam. 3dl., 2 stk. 1847, 13, not figured.
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DACTYLOPORELLA, Gümbel. Abh. k.-bayer Ak. Wiss München, XI, 1871, (1874), 231, etc., plates [= *Dactylopora*, q. v.]. [The species described are *D. cylindracea*, Lam.; *D. elegans*, Gümb.; *D. miocænica*, Karr.; *D. saccata*, Gümb.].
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——— **acuminata**, Terquem. Mém. Ac. Imp. Metz, XLIV. 1863, 383, vii, 9.

——— **acus**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 27, i, 15.

——— **acuta**, d'Orbigny. Foram. Fossiles Vienne, 1846, 56, ii, 40–43 [v. also *acutissima*].

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 30, iii, 20; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 36, same pl. and fig.

——— **acuticauda**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 62, iii, 8 [v. also *Nodosaria*].

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——— **acutissima**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 268, viii, 13.

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——— **æquabilis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 112, iv, 6.
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——— **baccata**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 601, ii, 9.
——— **badenensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 44, i, 48, 49.
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——— **benestarensis**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 137 and 220, xiii, 4.
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——— **beyrichana**, Neugeboren. Denkschr. k Ak. Wiss. Wien, XII, 2, 1856, 89, iv, 11.
——— **bicornis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 370, xxix, 13-17.
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——— **böttcheri**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 45, ii, 17.
——— **botuliformis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 370, xxix, 12.
——— **boueana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 47, ii, 4–6.
——— cfr. ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 28, xii, 11 and 19; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 34, same pl. and fig.
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——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 457, xviii, 20.
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——— **bucculenta**, Schwager. Dittmar, Die Contorta-Zone, 1864, 199, iii, 8.
——— **buchi**, Reuss. Zeitschr. deutsch geol. Ges. III, 1851, 60, iii, 6.
——— **budensis**, Hantken. A magy. kir. földt. int. évkonyve, IV, 1875 (1876), 28, iii, 12; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 34, same pl. and fig.
——— **bullata**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 107, iii, 23.
——— **burgundiæ**, Terquem. Tate & Blake, Yorkshire Lias, 1876, 461, xviii, 29 [*Marginulina*, 1863].
——— **cancellata**, Terquem. Sixième Mém. Foram. Lias, 1866, 488, xx, 1.
——— **capitata** (Boll). Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 223, i, 4 [*Nodosaria*, 1846].
——— ——— ——— *Ibid.* L, (1), 1864 (1865), 454, i, 8–10.
——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. 1868 (1870), 624, i, 42.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 29, iii, 16; and Mitth a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 35, same pl. and fig.
——— **carinata**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, 2, 1856, 91, iv, 17*a*, *b*, *c*.
——— **carinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 255, No. 39.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 159, ix, 50 [v. *Nodosaria*].
——— **cassiana**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 177, v, 16.
——— **catenula**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 185, iii, 6.
——— **caudata**, d'Orbigny. Ann. Sci Nat. VII, 1826, 254, No. 37.
——— **cenomana**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 185, No. 747.
——— **chrysalis**, Cornuel. Mém. Soc Géol. France, [2], III, 1848, 251, i, 21.
——— **chrysalis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 25, iii, 10.
——— **cingulata**, Czjzek. Haidinger's Nat. Abh. II, 1848, 139, xii, 8, 9.
——— **clava**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 28, ii (xii), 8*a*, *b*.
——— **clavata**, Terquem. Mém. Ac Imp. Metz, XXXIX, 1858, 598, ii, 3.
——— **claviformis**, Terquem. Sixième Mém. Foram. Lias, 1866, 490, xx, 4*a*, *b*.
——— **clavula**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 366, xxviii, 4.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 14, i, 37.
——— **cognata**, Reuss. Sitz. k. Ak. Wiss. Wien XL, 1860, 183 i, 9.
——— **cognata**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 32, ii (xii), 21*a*, *b*.

DENTALINA consobrina, d'Orbigny. Neugeboren, Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 86, iii, 15.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 306, xv, 22–23.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 45, ii, 19–23.
——— ——— ———. Hantken, A magy kir. földt. int. évkönyve, IV, 1875 (1876), 25, iii, 3 and 10; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 30, same pl. and fig.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 180, i, 10.
——— **contorta**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 30, iv, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 36, same pl. and fig.
——— **contracta**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xxvii, 12.
——— **cornicula**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 255, No. 47.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 161, ix, 56 [v. *Nodosaria*].
——— **corniculum**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xxvii, 14.
——— **cornuformis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 367, xxviii, 16.
——— **costata**, Eichwald. Lethæa Rossica, III, 1853, 10, i, 7*a*, *b*.
——— **crassicauda**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 138, xiii, 5.
——— **crassicosta**, Terquem. Mém. Soc. Géol. France, [3], IV, 1886, 13, i, 30 and 31.
——— **crassula**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 24, i, 8.
——— **crebricosta**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, 2, 1856, 90, iv, 12, 13.
——— **crenata**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 109, iii, 19 and 25.
——— **cuneiformis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 359, xxvi, 24–25; 361, xxvii, 4.
——— ——— ——— Terq. & Berthelin, Mém. Soc. Géol. France, [2], X, 1875, 27, ii (xii), 6*a*–*d*.
——— ——— ——— *Ibid.* [3], IV, 1886, 14, i, 35.
——— **cuvieri**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 255, No. 45.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 654, xxiv, 8.
——— **cylindracea**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 384, vii, 12*a*, *b*.
——— **cylindrica**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 111, iii, 28.
——— **cylindroides**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 185, i, 8.
——— ——— ——— *Ibid.* XLVI, (1), 1862 (1863), 40, ii, 16.
——— **debilis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 28, xiii, 10; and Mitth. a. d. Jahrb. k. ungar geol. Anstalt, IV, 1875 (1881), 33, same pl. and fig. [*Nodos.* (*Dent.*), 1868].
——— **declivis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 105, iii, 1.
——— **deflexa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 43, ii, 19.
——— **deformis**, Stache. Novara-Exped. Geol. (1), 1864. 205, xxii, 32.
——— **demissa**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 28, ii (xii), 10*a*–*g*.
——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII. 1826, 255, No. 43.
——— **detornata**, Schwager. Dittmar, Die Contorta-Zone, 1864, 199, iii, 9.
——— **diformis**, Terquem. Mém. Ac Imp. Metz, XLIV, 1863, 381, vii, 6*a*, *b*, *c*.
——— **discrepans**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 184, iii, 7.
——— **dispar**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 60, iii, 7.
——— **distincta**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 184, ii, 5.
——— **distorta**, Costa. Atti Accad Pontaniana, VII, (2), 1856, 173, xvi, 7.
——— **divergens**, Reuss. Sitz. k. Ak. Wiss. Wien, L, (1) 1864 (1865), 456, iv, 10.
——— **dolioligera**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 109, iii, 26 and 32.

DENTALINA floscula, d'Orbigny. Foram. Fossiles Vienne, 1846, 50, ii, 16, 17.
——— ——— ——— see *Orthoceratia flosculi.*
——— **foedissima**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 189, iii, 2, 3 [v. also *Haplophragmium* and *Haplostiche* and *Lituolina*].
——— **fontannesi**, Berthelin. Mém. Soc. Géol. France, [3], I, 1880, 42, ii (xxv), 14*a*–16*b*.
——— **fortinensis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 358, xxvi, 13–19; 361, xxvii, 1.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 13, i, 32 and 33.
——— **fraasi**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 110, iii, 24.
——— **fragilis**, Terquem. Mém. Ac Imp. Metz, XXXIX, 1858, 605, ii, 17.
——— **funiculosa**, Terquem. Sixième Mém. Foram. Lias, 1866, 486, xix, 29.
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 461, xviii, 28.
——— **funiculus**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 100, ii, 18.
——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [21], ii, 12.
——— **funiculus**, P. Fischer. Les fonds de la mer, II, 1875, 195, ix, 9. [There is no figure on plate ix: the "species" is said to be near *D. inornata*, d'Orb.]
——— **fusiformis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 99, ii, 16.
——— **fusiformis**, Gümbel. Geogn. Beschreibung Koenigsr. Bayern, I, 1861, 671.
——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 621, i, 35*a*, *b*.
——— **geinitzana**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 91, iv, 15.
——— **geniculata**, Terq. & Berth. Mém. Soc. Géol. France, [2], X, 1875, 32, ii (xii), 22.
——— **geniculosa**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 104, ii, 27.
——— **gibbosa**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 167, xii, 7.
——— **gigantea**, Hantken. A magy kir. földt. int. évkönyve, IV, 1875 (1876), 29, iii, 15; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 34, same pl. and fig.
? ——— **gigantea**, Alth. Pamietnik Akad. Umiej. Krakowie, VI, 1881, 133, xii, 24.
? ——— ——— ——— Alth, Mojsisovics und Neumayr's Beiträge Pal. Oest.-Ungarn, I, 1882, 316, xxix, 24.
——— **girardana**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 224, i, 6.
——— **glandifera**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 622, i, 37.
——— **glandulosa**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 440, v, 15*a*, *b*.
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 460, xix, 2.
——— **gliricauda**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 624, i, 41.
——— **globifera**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 223, i, 3.
——— **globulicauda**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 623, i, 38.
——— **globuligera**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 81, ii, 10.
——— **goldfussana**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 218, iii, 11*a*, *b*.
——— **gomphoides**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xxvii, 24 and 25.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 11 [?*Nod. obliqua*, d'Orb.].
——— **gracilis**, d'Orbigny. Mém. Soc. Géol. France, [1], IV, 1840, 14, i, 5; Facsimile in Science Gossip, 1870, 81, f. 78 [v. also *Nodosaria*].
——— ——— ——— Alth, Haidinger's Nat. Abh. III, (2), 1850, 269, xiii, 27.

DENTALINA intermedia, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 186, ii, 8.

—— **intermedia**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 25, iii, 4 and 8; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 30, same pl. and fig.

—— **intermittens**, Bronn. Index Palæont. I, 1848, 411 = *Nodosaria*, Roemer.

—— —— —— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 224, i, 7.

—— —— —— Gümbel, Geol. Bayern, I, (II), 1885, f. 266, 10.

—— **interrupta**, d'Orbigny. P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 155, ix, 51 [v. *Nodosaria*].

—— **intorta**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 364, xxvii, 26–34.

—— **irregularis**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, ivi, xxvii, 15.

—— —— —— *Ibid.* VII, (2), 1856, 166, xii, 23 and 27 [27 is *D. bifurcata* in descr. to plate].

—— **irregularis**, Eichwald. Lethæa Rossica, III, 1853, 9, i, 6*b*.

—— **irregularis**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 442, v, 21.

—— —— —— Terquem, Cinquième Mém. Foram. Lias, 1866, 409, xv, 13.

—— —— —— Deecke, Abh. geol. Specialkarte Elsass-Lothr. IV, (1), 1884, 25, i, 10.

—— **jugosa**, Williamson. Terquem, Ess. Anim. Plage Dunkerque, (1), 1875, 21, i, 7 (& Mém. Soc. Dunkerquoise) [v. *D. subarcuata*].

—— **juncea**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 369, xxix, 1 and 2.

—— **jurensis**, Terquem. *Ibid.* LI, 1870, 362, xxvii, 6–16

—— —— —— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 14, i, 36.

—— **kingii**, Jones. Jones in King, Pal. Soc. 1850, 17, vi, 2 and 3.

—— [**kingi**] —— Geinitz, Dyas, etc. 1861, (1), 122, xx, 33.

—— **konincki**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 356, i, 3.

—— —— var. **tumida**. Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 146, i, 19.

—— **korynephora**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, xix, 1869, 176, v, 3.

—— **lævigata**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 106, iii, 7 [*levigata* in text].

—— **lamarcki**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 91, iv, 16*a*, *b*.

—— **lamellosa**, Terquem. Cinquième Mém. Foram. Lias, 1866, 410, xv, 16*a*, *b*.

—— —— —— Terq. & Berth., Mém. Soc. Géol. France, [2], x, 1875, 29, ii (xii), 12*a*–*c*.

—— **lateralis**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 605, ii, 15*a*–*c*.

—— **legumen**, Linn. Williamson, Recent British Foram. 1858, 21, ii, 45–49, "45 typica" [*Nautilus*, 1758, v. *Vaginulina*].

—— —— —— v. **linearis**, Montagu. *Ibid.* 1858, 23, ii, 46–48 [*Nautilus*, 1808].

—— —— —— var. Williamson, Pop. Sci. Rev. IV, 1865, 174, viii. 6.

—— —— —— Chimmo, Bed of Atlantic, 1870, 26, ix, 6 [= *Nod. scalaris*].

—— **legumen**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 26, i, 14 [*Nodosaria*, 1845].

—— —— —— Reuss, Sitz. k. Ak. Wiss. Wien, XL, 1860, 187, iii, 5.

—— **leubeana**, Gümbel. Sitz. k.-bayer. Ak. Wiss. I, 1871, 64, i, 5 [? a sponge spicule].

—— **levigata**, Schwager. See *D. lævigata*.

—— **linearis**, (Röm.). Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 42, ii, 15[*Nodosaria* 1840].

—— —— —— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 622, i, 36*a*, *b*.

—— **linearis**, Will. Terquem, Ess. Anim. Plage. Dunkerque, (3), 1881, 113, xiii, 13 (& Mém. Soc. Dunkerquoise) [v. *D. legumen*, var.].

—— **lineata**, Reuss. Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 456, iv, 11.

—— **lilli**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 25, i, 11.

—— **longicauda**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 267, viii, 12.

—— **lorneiana**, d'Orbigny. Mém. Soc. Géol. France, [1], IV, 1840, 14, i, 8, 9; Facsimile in Science Gossip, 1870, 81, f. 80 [v. also *Nodosaria*].

DENTALINA nodigera, Terq. & Berthelin. Mém. Soc. Géol. France, [2], x, 1875, 25, i (xi), 31*a*, *b*.

——— **nodosa**, d'Orbigny. *Ibid.* [1], IV, 1840, 14, i, 6 and 7. Facsimile in Science Gossip, 1870, 81, f. 79 [v. also *Nodosaria*].

——— ——— ——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, 164, xii, 8.

——— ——— ——— P., J. & B. [Soldani]. Ann. Mag. Nat. Hist. [4], VIII, 1871, 158, ix, 55 [see *Nodos.*]

——— ——— ——— Vanden Broeck, Ann. Soc. Belge Micros. II, 1876, 89, ii, 10; and Fonds de la Mer, III, (1876).

——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 459, xviii, 26.

——— **notabilis**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], x, 1875, 31, ii (xii), 19 *a*, *b*.

——— **nummulina**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 626, i, 45.

——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 461, xviii, 30.

——— **obesa**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xxvii, 13.

——— **obliqua**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 254, No. 36. Modéles, 1826, No. 5 [v. *Nodosaria*].

——— **obliqua** (Linn.). Brady, Proc. Somerset. Arch. & Nat. Hist. Soc. XIII, 1865–6 (1867), 224, i, 17 [*Nautilus*, 1758].

——— ——— ——— J., P. & B., Crag Foram. Pal. Soc. XIX, 1866, 54, i, 9.

——— ——— ——— P., J. & B. [Soldani]. Ann. Mag. Nat. Hist. [4], VIII, 1871, 160, ix, 57 [see *Nod.* (*Dent.*) *cuvieri*, d'O.].

——— ——— ——— v. **sulcata**, Nilsson. Vanden Broeck, Ann. Soc. Belge Micros. II, 1876, 80, ii, 10 [error for 11]; and Fonds de la Mer, III, (1876) [*Nodosaria*, 1827].

——— ——— [Lam.] Koenen, Abh. k. Ges. Wiss. Göttingen, XXXII, 1885, 110, v, 21*a*, *b*.

——— **obliqua**, Wright. Proc. Belf. Nat. F. C. 1879–80, App. 207.

——— **obliquata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 46, ii, 25.

——— **obliquestriata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 63, iii, 11 and 12 [v. also *Nodosaria*].

——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 240, XXXV³, 1.

——— ——— ——— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 56, i, 19.

——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 460, xix, 4.

——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 751, xv, 15 (compare *Nautilus obliquatus*, Batsch).

——— ——— see *Orth.*, *seu tubuli*, etc.

——— **obliquesuturata**, Stache. Novara-Exped. Geol. (1), 1864, 207, xxii, 36.

——— **obscura**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 597, ii, 2*a*, *b*.

——— ——— ——— var. Terquem, *Ibid.* XLII, 1862, 441, v, 18*a–c*.

——— **obscura**, Stache. Novara-Exped. Geol. (1), 1864, 208, xxii, 37.

——— **obtusata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 151, viii, 1.

——— **octoplicata**, Terquem. Sixième Mém. Foram. Lias, 1866, 489, xx, 3*a*, *b*.

——— **oculina**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], x, 1875, 31, ii (xii), 20*a–c*.

——— **oligosphærica**, Reuss. Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 453, iv, 9.

——— **oligostegia**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 25, i, 10 [*Nodosaria*, 1845].

——— ? ——— ——— Tate & Blake, Yorkshire Lias, 1876, 458, xviii, 21.

——— **oolithica**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 366, xxviii, 5–15.

——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 14, i, 38–40.

——— **oppeli**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 108, iii, 16, 17.

——— **orbignyana**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 82, iii, 1–3 [including *D. inornata*, d'Orb., and *D. pauperata*, d'Orb.].

——— **ornata**, Neugeboren. *Ibid.* XII, (2), 1856, 88, iv, 9*a*, *b*.

DENTALINA prælonga, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 163, xii, 21; xxvii, 16–19.
——— **primæva**, d'Orb., 1849. D'Orbigny, Prodrome de Paléont. I, 1849, 242, No. 260.
——— ——— ——— Terquem, Mém. Ac. Imp. Metz, XXXIX, 1858, 603, ii, 12*a*, *b*.
——— **priscilla**, Dawson. Acadian Geology, ed. 2, 1868, 285, f. 82; and ed. 3, 1878, 285, f. 82 [= *Nodosinella*, q. v.].
——— **propinqua**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 365, xxviii, 1 and 2.
——— **proteus**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 306, i, 6–9.
——— **pseudochrysalis**, Reuss. *Ibid.* XLVI, (1), 1862 (1863), 39, ii, 12.
——— **pseudomonile**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 606, ii, 18.
——— **pugiunculus**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 183, iii, 9.
——— ——— ——— Schwager, Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 111, iv, 1,
——— **pulchra**, Gabb. Journ. Ac. Nat. Sci. Philad. n. s., IV, (4), 1860, 402, lxviii, 40 and 41 [error for lxix] [= *Nodos. zippei*, Reuss].
——— **punctata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 49, ii, 14 and 15.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, (2), 1876, 69, vii, 13; and (3), 1881, 112, xiii, 8 and 9 (& Mém. Soc. Dunkerquoise).
——— **pungens**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 64, iii, 13 [v. also *Nodosaria*].
——— ——— ——— v. **rugulosa**. Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 625, i, 44.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 30, iv, 3; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 36, same pl. and fig.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 36, i (ix), 39.
——— **pupiformis**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 385, vii, 13*a*, *b*, *c*.
——— **pusilla**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 104, iii, 3.
——— **pygmæa**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 80, ii, 9 [v. also *Nodosaria*].
——— **pyriformis**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 608, ii, 22.
——— **quadricosta**, Terquem. *Ibid.* XLII, 1862, 439, v, 16*a*, *b*.
——— ——— ——— Terq. & Berthelin, Mém. Soc. Géol. France, [2], X, 1875, 31, ii (xii), 17.
——— **quadrilatera**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 605, ii, 14*a*, *b*.
——— **quenstedti**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 109, iii, 22.
——— **radiata**, Terquem. Sixième Mém. Foram. Lias, 1866, 490, xx, 5*a*, *b*.
——— **radicula**, Terquem. Cinquième Mém. Foram. Lias, 1866, 406, xv, 8*a*, *b*.
——— **rapa**, d'Orb. Tate & Blake, Yorkshire Lias, 1876, 460, xix, 3 [v. *Nodosaria*].
——— **raphanistriformis**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 219, iii, 12*a*. *b*.
——— **recta**, Gosse. Manual Mar. Zool. 1855, 12, f. 11.
——— **reitzi**, Hantken. A magy. kir. foldt. int. évkönyve, IV, 1875 (1876), 27, xiii, 6; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 33, same pl. and fig. [*Nodos.* (*Dent.*), 1868].
——— **renati**, Terquem. Cinquième Mém. Foram. Lias, 1866, 411, xv, 18*a*, *b*.
——— **retrorsa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863 (1864), 46, iii, 27 [v. also *Nodosaria*].
——— **reussi**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 85, iii, 6, 7 and 17.
——— **robusta**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 34, iv, Impressathon 6.
——— ——— ——— Deecke, Abh. geol. Specialkarte Elsass-Lothr. IV, (1), 1884, 24, i, 13.
——— **roemeri**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 82, ii, 13–17 [v. also *Nodosaria*].

DENTALINA sphærophora, Ehrenberg. Mikrogeologie, 1854, xxvi, 5 [= *Nodos. gracilis*, d'O. (Soldani)].
——— **spinescens**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 62, iii, 10 [v. also *Nodos.* (*Dent.*)].
——— ——— ——— var. Bornemann, *Ibid.* VII, 1855, 324, xiii, 5 [*D. adolphina* in descr. of plate].
——— **spinigera**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 86, iii, 16.
——— **spinosa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 55, ii, 36 and 37.
——— **spinulosa** (Mont.). Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 751, xv, 13 [*Nautilus*, 1808].
——— **strangulata**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 185, ii, 6.
——— **strangulata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 382, vii, 7*a*, *b*.
——— ——— ——— Terquem, Cinquième Mém. Foram. Lias, 1866, 411, xv, 17.
——— **steenstrupi**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 268, viii, 14*a*.
——— **striatissima**, Stache. Novara-Exped. Geol. (1), 1864, 208, xxii, 38.
——— **striatula**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, (1), 1884, 24, i, 11, 11*a*.
——— **strigosa**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 168, xii, 6.
——— **subarcuata** (Mont.). Williamson, Recent British Foram. 1858, 18, ii, 40–44, "40, 41, typica" [v. *Nautilus*, 1803].
——— ——— ——— v. **jugosa**, Montagu. Williamson, Recent British Foram. 1858, 20, ii, 42–44 (43 compare *N. catenulata*), [*Nautilus*, 1803].
——— ——— ——— Chimmo, Bed of Atlantic, 1870, 22, vi, 11.
——— ——— ——— Figuier, Ocean World, [1873], 84, f. 18.
——— **subcanaliculata**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 87, iv, 5, 6 [v. also *Nodos.* (*Dent.*)].
——— **subelegans**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 443, v, 23*a*, *b*.
——— **sublaxa**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 24, no fig.; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 29.
——— **sublinearis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 103, ii, 26.
——— **subnodosa**, Reuss. Haidinger's Naturw. Abh. IV, (1), 1851, 24, i, 9 [referred to *Pleurostomella*, 1860].
——— **subnodosa**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 600, ii, 7.
——— **subplana**, Terquem. *Ibid.* LI, 1870, 367, xxviii, 17–30.
——— **subrecta**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 182, i, 10.
——— **subspinosa**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 88, iv, 7*a*, *b*, *c*.
——— **substriata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 255, No. 46.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 160, ix, 54 [see *Nod.* (*D.*)].
——— **subtilis**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 83, iii, 4.
——— ——— ——— Hantken, A. magy. kir. földt. int. évkönyve, IV, 1875 (1876), 28, iii, 13; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 33, same pl. and fig.
——— **subulata**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, (2), 1856, 84, iii, 13 (including *D. badenensis*, d'O).
——— **succincta**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 359, xxvi, 21–23.
——— ——— ——— Terq., Bull. Soc. géol. France, [3], IV, 1876, 482, xv, 9.
——— **sulcata**, d'Orbigny. Mém. Soc. Géol. France, [1], IV, 1840, 15, i, 10–13; Facsimile in Science Gossip, 1870, 81, fig. 81 [compare *Nod. sulcata*, Nilss.].
——— ——— ——— Beudant, Géologie, ed. 8, 1858, 117, f. 92, later eds., same fig.
——— **sulcata**, Nilss. Reuss in Geinitz, Grundr. Verstein. 1845–46, 655, xxiv, 11 [*Nodosaria*, 1825].
——— ——— ——— Reuss, Zeitschr. deutsch geol. Ges. VII, 1855, 269, viii, 14*b*.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 486, xi, 24.
——— **supracorallina**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 38, iv, Badener Schicht 5.

DENTALINA verticalis, Stache. Novara-Exped. Geol. (1), 1864, 202, xxii, 28*a*, *b*.
—— **vetusta**, d'Orb., 1849. D'Orbigny, Prodrome de Paléont. I, 1849, 242, No. 258.
—— —— —— Terquem, Mém. Ac. Imp. Metz, XXXIX, 1858, 598, ii, 4*a*, *b*.
—— **vetustissima**, d'Orb., 1849. D'Orbigny, Prodrome de Paléont. I, 1849, 242, No. 261.
—— —— —— Terquem, Mém. Ac. Imp. Metz, XXXIX, 1858, 600, ii, 8.
—— —— —— Terq. & Berthelin, Mém. Soc. Géol. France, [2], x, 1875, 24, i (xi), 29*a*, *b*.
—— **virgata**. Terquem. Sixième Mém. Foram. Lias, 1866, 489, xx, 2.
—— **xiphioides**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 43, iii, 1.
—— **zsigmondyi**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 27, xii, 17; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 32, same pl. and fig.
—— sp. Costa. Atti Accad. Pontaniana, VII, (2), 1856, xii, 28.
—— sp. ind. Stache, Novara-Exped. Geol. (1), 1864, 204, xxii, 30; 209, xxii, 39; 210, xxii, 41.
—— sp. Schwager, Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 105, ii, 28; iii, 2, 29 and 30; iv, 2–5, 8.
—— sp. ind. Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 28, iii, 11; xii, 18; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 34, same pl. and fig.
—— sp. Terrigi, Atti. Acc. Pont. Nuovi Lincei, XXXV, 1883, 180, ii, 16.
? —— Pilla, Disting. terr. Etrurio, 1846, 103, i, 3.
—— Williamson, Mem. Lit. Phil. Soc. Manchester, [2], VIII, 1848, 78, pl., 69, 70, 72 [69 = *Marg. raphanus*].
? —— Jones in King, Pal. Soc. 1850, 17, vi, 4.
—— Costa, Mem. Acc. Sci. Napoli, II, 1855 (1857), 142, i, 14, 15, 19, 20 [gutta], 25, 26, 29–33, 35, 36.
—— Costa, Atti. Accad. Pontaniana, VII, (2), 1856, not descr., xvi, 20 and 21.
—— v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, plates viii–x and xxxviii.
—— Terq. & Berth., Mém. Soc. Géol. France, [2], x, 1875, 27, ii (xii), 7, *a–j*, [fragments].
—— v. Dunikowski. Denkschr. k. Ak. Wiss. Wien, XLV, (2), 1882, 194, vi, 71, fragment.
—— Bornemann, Jahrb. k. pr. geol. Landesanstalt, 1885 (1886), 292, xiii, 1*a*.
—— de Folin, Le Naturaliste, IX, 1887, 140, f. 20*a*.
—— Neumayr, Stämme d. Thierreiches, I, 1889 (8), 183, f. 25*c*.
—— see *Nodosaria*.
DENTALINOPSIS, Reuss, 1860. Sitz. k. böhm. Gesell. Wiss. Jahrg. 1860, Jan.–Juni, 91.
—— **semitriquetra**, Reuss. *Ibid.* 1860, Jan.-Juni, 92.
—— —— —— Reuss' Model. No. 28, 1865 (Catal. No. 52, 1861) [= triangular *Dentalina*].
—— **subtriquetra**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 57, v, 6*a*, *b*.
—— —— —— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 10.
DEXIOPORA, Ehrenberg, 1858. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 309.
—— **borealis**, Ehr. *Ibid.* 1872, 282.
—— **hexarchæa**, Ehr. *Ibid.* 1858, 309 and 337, I, f. xi, *a*, *b* [glauconite], [? Rotaline].
?—— **megapora**, Ehr. *Ibid.* 1861, 304.
—— **triarchæa**, Ehr. *Ibid.* 1858, 309 and 337, I, f. x [glauconite] ["may be *Globigerina*," P. & J.]
DIAPHOROPODON, Archer, 1869. Quart. Journ. Micr. Sci. n. s. IX, 1869, 394, xx, 6 and x, 1870, 123 [*D. mobile*] [one of the *Gromidæ*].
DICYCLINA, Munier-Chalmas, 1887. Compte-Rendu Sommaire Soc. géol. France, No. 7, 21 Fév., 1887, xxx.
—— **schlumbergeri**, Mun.-Ch. *Ibid.* xxxi, no fig. ["Couches moyennes à *Hippurites* de l'Étang de Berre."]

DIMORPHINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 264; see Brady, Parker & Jones, Trans. Linn. Soc. XXVII, 1870, 248.
——— **compacta**, Brady, Parker & Jones. Trans. Linn. Soc. XXVII, 1870, 250, xlii, 41.
——— **corallensis**, Buvignier. Stat. géol., etc., Meuse, 1852, Atlas, 47, xxxii, 35.
——— **elegans**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 54, vii, 9; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 63, same pl. and fig.
——— **inflata**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xv, 11.
——— **inflexa**, Alth. Pamietnik Akad. Umiej. Krakowie, VI, 1881, 133, xi, 18.
——— ——— Alth, Mojsisovics und Neumayr's Beiträge Pal. Oest.-Ungarn, I, 1882, 315, xxviii, 18.
——— **mosensis**, Buvignier. Stat. géol. etc., Meuse, 1852, Atlas, 47, xxxii, 29.
——— **nodosaria**, d'Orbigny. Foram. Fossiles Vienne, 1846, 221, xii, 21 and 22.
——— ——— ——— J., P. & B. Crag Foram. Pal. Soc. XIX, 1866, n. d., i, 55–58 and 61.
——— **obliqua**, d'Orbigny. Foram. Fossiles Vienne, 1846, 220, xii, 18–20.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 231, xxxv², 26*a*, *b*, *c*.
——— ——— ——— Reuss' Model. No. 94, 1865 (Catal. No. 72, 1861).
——— ——— ——— B., P. & J., Trans. Linn. Soc. XXVII, 1870, 250, xlii, 40*a–c*.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 36.
——— **planularia**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 426.
——— **saxipara**, Ehrenberg. Mikrogeologie, 1854, XXXII, ii, 27 [= *Bifarina saxipara* (Ehr.)].
——— ——— ? ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 176, vii, 10 (*Textil.?*) [= *Text. globulosa*].
——— **strangulata**, Buvignier. Stat. géol. etc., Meuse, 1852, Atlas, 47, xxxii, 34.
——— **striata**, Schwager. Novara-Exped. Geol. (2), 1866, 251, vii, 99, and fig. 2 [v. *Sagrina*].
——— **tenella**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 426.
——— **tuberosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 264, No. 1.
——— ——— ——— D'Orb., Modèles, No. 60, 1826.
——— ——— ——— P., J. & B. [d'O., Modèles, 60], Ann. Mag. Nat. Hist. [3], XVI, 1865, 28, ii, 53.
——— ——— ——— J., P. & B., Crag Foram. Pal. Soc. XIX, 1866, n. d , i, 66.
——— ——— ——— B., P. & J , Trans. Linn. Soc. XXVII, 1870, 249, xlii, 39*a*, *b*.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 170, xi, 108.
——— ——— [Soldani]. Bassett, Ann. Soc. Sci. Charente-Inf. 1884 (85), 161, fig.
——— ——— ——— see *Orthoceras tuberosum*.
——— **tyraica**, Alth. Pamietnik Akad. Umiej. Krakowie, VI, 1881, 132, xii, 25.
——— ——— Alth, Mojsisovics und Neumayr's Beiträge Pal. Oest.-Ungarn, I, 1882, 315, xxix, 25.
——— **zittelli**, Karrer. In v. Drasche, Frag. Geol. Luzon, 1878, 95, v, 21; and Boll. Com. Map. Geol. Españ. VII, 1880, 278, F, 7.
——— sp. Zittel, Handbuch Palæont. (1), 1876, 86, f. 23³.
——— d'O. v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, plates xxvi, xxvii and xxx.

DIOXEIA richardi, de Folin. Naturaliste, IX, 1887, 115, f. 11 [v. *Dyoxeia*].

DIPLOMASTA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 136, not described; 1 species proposed.

DISCOCYCLINA, Gümbel, 1868. Abh. k.-bayer. Ak. Wiss. X, (2), 1868 (1870), 687. This subgenus of *Orbitoides* was proposed by Gümbel for the following forms:—*D. papyracea* (Boubée); *D. ephippium* (Schlotheim); *D. tenella*, Gümbel; *D. aspera*, Gümbel; *D. applanata*, Gümbel; *D. dispansa* (Sowerby)

DISCOIDINA, Terquem & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 15.
——— **liassica**, Terq. & Berth *Ibid.* [2], X, 1875, 15, i (xi), 5*a*, *b*.

DISCOLITE microscopica, a superficie liscia. Fortis, Opusc. Scelti Sci. Arti, XXII, 1803, 158, iii, 1–5 [1–4 *Nummulites*, 5 ?].

DISCOLITE nummiforme, piatta, che da ambo i lati mostra le spire e le concameragione. *Ibid.* XXII, 1803, 159, iii, 6*a*, *b* [*Nummulite*].

[———] **nummiforme, a superficie convessa a bottoni regolari formanti raggi e strati concentrici.** *Ibid.* XXII, 1803, 159, iii, 7 and 8 [*Numm. scabra* ?].

——— **orbicolare, piatta con un bottoncino al centro ov' è depressa,** etc. *Ibid.* XXII, 1803, 159, iii, 13 [*Alveolina*].

——— **ovale, piatta, con un incavo congitudinale, orlo ottuso.** *Ibid.* XXII, 1803, 159, iii, 12 [? inorganic].

——— **a raggi prominenti rettilinei dal centro al margine.** *Ibid.* XXII, 1803, 159, iii, 9–11 [*Orbit. stellata*, d'Arch.].

——— **sferica, longitudinale divisa in sei lobi, leggermente striata intorno.** *Ibid.* XXII, 1803, 160, iii, 14–17 [14, 15 = *Alveol. ovoidea;* 16, 17, *Alveol. elongata* ?].

DISCOLITES concentricus, Montfort. Conch. syst. I, 1808, 187, 47 genre [= *Orbitolites complanatus*].

DISCOLITHES, Fortis. Journ. de Physique, LII, 1801, 106, etc., pl. II, 1–12 [= *Alveolinæ*].

——— Fortis, Mém. Hist. Nat. Oryct. Italie, etc. 1802, II, 5.

DISCOLITHUS [" chiefly *Nummulites*," v. d'Archiac and Haime].

——— **adamussim lenticularis,** etc. *Ibid.* 1802, II, 101, i, *n*, *o*.

——— ——— **lentiformis, lævis,** etc. *Ibid.* 1802, II, 100, i, *l*, *m*.

——— **compactus, nec externa, nec interna cavitatum,** etc. *Ibid.* 1802, II, 114, iii, 12–14, 3 var.

——— **compresse sphæroideus margine tenuissimo auctus.** *Ibid.* 1802, II, 102, i, *u*, *v*.

——— ——— ——— **nullo margine auctus.** *Ibid.* 1802, II, 102, i, *s*, *t*.

——— **centro vix prominulo, lævis,** etc. *Ibid.* 1802, II, 98, i, *e*, *f*, *g* [= ? *Operculina*].

——— **exacte orbicularis,** etc. *Ibid.* 1802, II, 111, iii, 4.

——— **lentiformis,** etc. *Ibid.* 1802, II, 106, ii, *M*, *N*, *O*.

——— **minimus, lentiformis, superficio lineolis,** etc. *Ibid.* 1802, II, 98, i, *c*, *d* [= *Nummulites*].

——— ——— **superficie, lævi, lentiformis.** *Ibid.* 1802, II, 98, i, *a*, *b*.

——— **nummiformis,** etc. *Ibid.* 1802, II, 102, ii, *A*, *B*, *C* [= *Nummulites*].

——— ——— **ad marginem papyraceus,** etc. *Ibid.* 1802, II, 105, ii, *K*, *L*.

——— ——— **papyraceus,** etc. *Ibid.* 1802, II, 104, ii, *F*, *G*, *H*.

——— ——— ——— **centro prominulo.** *Ibid.* 1802, II, 105, ii, *I*.

——— ——— **superficie, regulariter verrucosa.** *Ibid.* 1802, II, 106, ii, *Q*.

——— ——— ——— **irregulariter verrucosa,** etc. *Ibid.* 1802, II, 107, ii, *R*.

——— **ovalis,** etc. *Ibid.* 1802, II, 109, ii, *Z*, Z^1, Z^2 [= ? *Alveolina*].

——— **quadraginta-radiatus,** etc. *Ibid.* 1802, II, 108, ii, *Z* [error for *Y*] [= *Nummulites*].

——— **radiatus,** etc., four var. *Ibid.* 1802, II, 107, ii, *S*, *T*, *U*, *V* [= *Orbitoides stellata*].

——— **radiis confertis dichotomis,** etc. *Ibid.* 1802, II, 108, ii, *X* [= *Orbitoides stellata*].

——— **sphæricus gracilis apicibus, acutis.** *Ibid.* 1802, II, 114, iii, 10 and 11 [= *Alveolina fusiformis*].

——— **sphericus in sex lobos divisus,** etc. *Ibid.* 1802, II, 112, i*; iii, 6 [= *Alveolina melo*].

——— **sphæricus superficie undequaque lævi.** *Ibid.* 1802, II, 102, i, *x*, *y*, *z*.

——— **sphæroideus oblongus.** *Ibid.* 1802, II, 113, iii, 8*c*, *d* [v. *Alveolina sphæroidea* (Fortis) = *A. elongata*].

——— **superficie lævi,** etc. *Ibid.* 1802, II, 101, i, *p*, *q*, *r*.

——— ——— **utrinque assurgente,** etc. *Ibid.* 1802, II, 99, i, *h*, *i* [= *Nummulites*].

——— ——— ——— **centrum versus depressa,** etc. *Ibid.* 1802, II, 103, ii, *D*, *E*.

——— **utrinque convexus lineolis rectis,** etc. *Ibid.* 1802, II, 99, i, *j* [= *Nummulites*].

——— Fortis in *Ibid.* 1802, II, has the following figures which are undescribed: i**; ii *J*, *P;* iii, 1, 7, 9, 15–18 [p. 119]; iv *a–e* 1–8 [pieces of nummulitic rock; 1 is *Orbitoides*].

DISCORBINA, Parker & Jones, 1862. Carpenter, Parker & Jones, Introd. Foram. 1862, 203; Brady, Report Challenger, 1884, 640.

——— **agrigentina**, Schwager. Boll. R. Com. Geol. Ital. IX, 1878, 525, i, 13

——— **alata**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, X, 1878, 165, iv, 33*a–d*.

——— **allomorphinoides** (Rss.). Brady, Report Challenger, 1884, 654, xci, 5 and 8 [*Valvulina*, 1860].

——— **ammonoides**, Reuss. Sitz. k. Ak. Wiss. Wien, LII, 1865, 456, No. 5 [v. *Planorbulina*, *Anomalina* and *Rosalina*].

——— **anomala**, Schwager. Boll. R. Com. Geol. Ital. IX, 1878 524, i, 11.

——— **araucana** (d'O.). Brady, Report Challenger, 1884, 645, lxxxvi, 10, 11 [*Rosalina*, 1839].

——— **arcuata**, Reuss. Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 194, iii, 37 [*Rosalina*, 1850].

——— **baconica**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 66, x, 3; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 76, same pl. and fig. [v. *D. bertheloti*].

——— **badensis**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 387, xvi*b*, 54.

——— **bembix**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, X, 1878, 167, v, 37*a–d*.

——— **bertheloti** (d'Orb.). Brady, Trans. Linnean Soc. XXIV, 1864, 469, xlviii, 10 [*Rosalina*, 1839].

——— ——— ——— Brady, Report Challenger, 1884, 650, lxxxix, 10–12.

——— ——— ——— v. **baconica**, Hantk., var. *Ibid.* 1884, 651, xc, 1*a*, *b*, *c* [*D. baconica*, 1875].

——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 227, xlvi, 7 8.

——— **berthelotiana**, d'Orbigny, v. *Rosalina*.

[——— ——— ———] Macdonald, Annals and Mag. Nat. Hist. [2], XX, 1857, 193, vi, 25.

——— ——— ——— Goës, K. Svenska. Vet.-Akad. Handl. XIX, No. 4, 1882, 107, viii, 266–268.

——— ——— ——— v. *D. turbo* (d'O.).

——— **biconcava**, Jones & Parker. Carpenter, Parker & Jones, Introd. Foram. 1862, 201, f. xxxii, *G*.

——— ——— ——— Parker & Jones, Phil. Trans. 1865. 385 and 422, xix, 10*a*, *b*, *c*.

——— ——— ——— Brady, Report Challenger, 1884, 653, xci, 2 and 3.

——— **binkhorsti** (Reuss), v. *Rosalina*.

——— **bulloides**, d'Orbigny. Goës, K. Svenska. Vet.-Akad. Handl. XIX, No. 4, 1882, 106, viii, 262 and 263 [*Rosalina*, 1839].

——— **calcariformis**, Schwager. Palæontographica, XXX, 1883, Pal. Theil. 120, xxvii, (4), 9*a–d*.

——— **concamerata** (Montagu). Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 96, ix, 16 and 17 [*Serpula*, 1808].

——— **concinna**, Brady. Report Challenger, 1884, 646, xc, 7 and 8.

——— **cora** (d'Orbigny), v. *Rosalina*.

——— **crenulata**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, (1), 1869, 462, II. 3*a–c*.

——— **cruciformis**, Howchin. Trans R. Soc. S. Austral. XII, 1889, 12. i, 13, 14.

——— **danubia**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 184, ii, 15.

——— **deceptoria**, Schwager. Palæontographica, XXX, 1883, Pal. Theil, 119, xxvii, (4), 7*a–d*.

——— **dimidiata**, Jones & Parker. Carpenter, Parker & Jones, Introd. Foram. 1862, 201, f. xxxii, *B*.

——— ——— ——— Parker & Jones, Phil. Trans. 1865, 385 and 422, xix, 9*a*, *b*, *c*.

——— **disca**, Hantken. A magy. kir. földt int évkönyve, IV, 1875 (1876), 66, xv, 9; and Mitth a. d. Jahrb. k. ungar geol. Anstalt, IV, 1875 (1881), 76, same pl. and fig. [given as *Pulvin. umbilicata* in descr. of plate].

——— **elegans** (d'Orbigny) v. *Anomalina*.

——— **elegans**, Hantken. A magy kir. földt. int. évkönyve, IV, 1875 (1876), 66, ix, 3, xv, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 76, same pl. and fig.

——— **eximia**, Hantken. *Ibid* IV, 1875 (1876), 66, xv, 8; and *Ibid.* IV, 1875 (1881), 76, same pl. and fig.

DISCORBINA eximia, Hantken. Brady, Report Challenger, 1884, 646, lxxxviii, 9*a*, *b*, *c*.
——— **floscellus**, Schwager. Palæontographica, xxx, 1883, Pal. Theil, 122, xxvii (4), 11*a–d*.
——— **formosa**, Toutkowsky. Zap. Kievsk. Obsch. Est. VIII, 1887, 357, vi, 7*a–c*.
——— **globigerinoides**, Parker & Jones. Parker & Jones, Phil. Trans. 1865, 385 and 421, xix, 7*a*, *b*, *c*.
——— **globosa** (v. Hag.). Marsson, Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, x, 1878. 163, iv, 32*a–d* [*Nonionina*, 1842].
——— **globularis** (d'Orbigny). Carpenter, Parker & Jones, Introd. Foram. 1862, 204, iii, 1 [*Rosalina*, 1826].
——— ——— ——— Dawson, Canad. Nat. [2], VII, 1874, 253, f. *c*.
——— ——— ——— Dawson, Proc. Amer. Assoc. 1876 (Detroit), 103, f. 4*c*.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 201, iii, 56.
——— ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 96, ix, 18.
——— ——— ——— Brady, Report Challenger, 1884, 643, lxxxvi, 8 and 13.
——— ——— ——— Walther. Mitth. Zool. Stat. Neapel, VIII, 1888, 382, xx, 1.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 226, xlvi, 6.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, (4), VI, 1889, 115, vi, 20.
[——— ———? ———] Macdonald, Annals and Mag. Nat. Hist. [2], xx, 1857, 193, v, 17 and 20.
——— ——— ——— see *D. turbo* (d'O.).
——— **globularis**, Karrer. Abh. k. k. Geol. Reichs, IX, 1877, 387, xvi*b*, 55.
——— **gracilis**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, x, 1878, 166, iv, 34*a*, *b*, *c*.
——— **granosa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 148, xiv, 1*a*, *b* [error for 2].
——— **imperatoria** (d'Orbigny), v. *Rosalina*.
——— **inæqualis** (d'Orb.). Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 97, ix, 19 [*Valvulina*, 1839].
——— **indistincta**, Schwager. Boll. R. Com. Geol. Ital. IX, 1878, 525, i, 12.
——— **isabelleana** (d'O.). Brady, Report Challenger, 1884, 646, lxxxviii, 1*a*, *b*, *c* [*Rosalina*, 1839].
——— **karreri**, Uhlig. Mojsisovics und Neumayr's Beiträge, Pal. Oest.-Ungarn, I, 1882, 182, xiv, 4–6.
——— **leopolitana**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 127, ii, 5.
——— **lucida**, Karrer. Abh. k. k. Geol. Reichs. IX, 1877, 387, xvi*b*, 56.
——— **marginata**, Reuss. Sitz. k. Ak. Wiss. Wien, LII, 1865, [12], No. 2 [= *Globigerina*, q. v.].
——— **megasphærica**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 655, ii, 96*a*, *b* [v. *Rotalina*].
——— **mensilla**, Schwager. Palæontographica, xxx, 1883, Pal. Theil, 123, xxv (2), 5*a–d*.
——— **micheliniana**, Reuss. Sitz. k. Ak. Wiss. Wien, LII, 1865, 445, No. 1 [= *Pulvinulina*, q. v].
——— **minuta**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 148, xiv, 3*a*, *b* [this is not figured].
——— **minutissima**, Seguenza. *Ibid.* [3], VI, 1880, 149, xiv, 4*a*, *b* [error for i, 1].
——— **multifaria**, Schwager. Palæontographica, xxx, 1883, Pal. Theil, 121, xxvii (4), 10*a–c*; xxix (vi), 17*a–d*.
——— **nana** (Reuss), v. *Rotalina*.
——— **obtusa** (d'Orbigny). Brady, Report Challenger, 1884, 644, xci, 9*a*, *b*, *c* ? [*Rosalina*, 1846].
——— ——— ——— see *D. turbo* (d'O.).
——— **opercularis** (d'O.). Brady, Report Challenger, 1884, 650, lxxxix, 8, 9 [*Rosalina*, 1826].
——— **orbicularis** (Terquem). *Ibid.* 1884, 647, lxxxviii, 4–8 [*Rosalina*, 1876].

DISCORBINA sacharina, Schwager. Novara-Exped. Geol. (2), 1866, 257, vii, 106.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 48.
——— **saulcii** (d'Orbigny). Brady, Report Challenger, 1884, 653, xci, 6*a*, *b*, *c* [*Rosalina*, 1839].
——— **semiorbis**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, (1), 1868, 185, v, 5.
——— **semiumbilicata**, Toutkowsky. Zap. Kievsk. Obsch. Est. VIII, 1887, 358, v, 5*a–d*.
——— **simulatilis**, Schwager. Palæontographica, XXX, 1883, Pal. Theil, 120, xxix (6), 15*a–d*
——— **solarium**, Seguenza. Atti R. Acc. Lincei, (3), VI, 1880, 64, vii, 9.
——— **sphæruligera**, Schwager. Palæontographica, XXX, 1883, Pal. Theil, 119, xxvii (4), 8*a–d*.
——— **squamula**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, (1), 1867, 101, v, 2*a–c*.
——— **stellata**, Reuss. *Ibid.* LV, (1), 1867, 101, v, 1*a–c*.
——— ——— ——— Reuss, *Ibid.* LIX, (1), 1869, 463, ii, 4*a–c*.
——— **sub-vilardeboana**, Rzehak. Ann. k. k. nat. Hofmuseums, III, (3), 1888, 263, xi, 6*a*, *b*, *c*.
——— **tabernacularis**, Brady. Report Challenger, 1884, 648, lxxxix, 5–7.
——— ——— ——— Brady, Quart. Journ. Micro. Sci. XXI, 1881, 652.
——— **theofilaktowi**, Toutkowsky. Zap. Kievsk. Obsch. Est. VIII, 1887, 356, vi, 6*a–c*; vii, *e*.
——— **trochidiformis** (Lam.). Jones in Dixon, Geol. of Sussex, ed. 2, 1878, 172, ix [10], 6 [*Rotalites*, 1804]
——— **tuberculata**, Balkwill & Wright. Trans. R. Irish Ac. XXVIII, (Sci.), 1885, 350, xiii, 28–30.
——— **turbo** (d'O.) (varieties). Parker & Jones, Phil. Trans. 1865, 384, xiv, 18–23; xvi, 26–28 [*Rotalia*, 1826].
——— ——— ——— v. **parisiensis** (d'O.), subv. **berthelotiana** (d'O.). Parker & Jones, Phil. Trans. 1865, 387, xvi, 26, 27.
——— ——— ——— v. **rosacea** (d'O.). *Ibid.* 1865, 385, xvi, 28*a*, 28*b*.
——— ——— ——— v. **vesicularis** (Lam.), subv. **globularis** (d'O.). *Ibid.* 1865, 386, xiv, 20–23.
——— ——— ——— v. **vesicularis** (Lam.), subv. **obtusa** (d'O.). *Ibid.* 1865, 386, xiv, 18, 19.
——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 206, ix, 10.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 193, iii, 35, 36.
——— ——— ——— Brady, Report Challenger, 1884, 642, lxxxvii, 8*a*, *b*, *c*.
——— ——— ——— Gümbel, Geol. Bayern. I, (2), 1885, f. 266, 21.
——— **turris**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, (1), 1868, 185, v, 4.
——— **umbonifera** (var.), Schwager. Palæontographica, XXX, 1883, Pal. Theil, 126, xxvii (4), 14*a–d*.
——— **valvulata**, d'O. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 106, viii, 258–261 [*Rosalina*, 1826].
——— ——— ——— Brady, Report Challenger, 1884, 644, lxxvii, 5–7.
——— ——— ——— ? Terrigi, Mem. R. Acc. Lincei, (4); VI, 1889, 115, vii, 1.
——— **ventricosa**, Brady. Report Challenger, 1884, 654, xci, 7*a*, *b*, *c*.
——— **vesicularis** (Lamarck). Carpenter, Parker & Jones, Introd. Foram. 1862, 203, xiii, 2, 3 [*Discorbites*, 1804].
——— ——— [d'O.]. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 206, ix, 6.
——— ——— ——— v. **elegans**, d'Orb. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 108, viii, 269–271.
——— ——— ——— Brady, Report Challenger, 1884, 651, lxxxvii, 2*a*, *b*, *c*.
——— ——— ——— see *D. turbo* (d'O.).
——— **vesiculata**, Uhlig. Mojsisovics und Neumayr's Beiträge, Pal. Oest.-Ungarn, I, 1882, 181, xvi, 4–6.
——— **vestita**, Seguenza. Atti R. Ac. Lincei, [3], VI, 1880, 148, xiii, 39.
——— **vilardeboana** (d'O.). Brady, Report Challenger, 1884, 645, lxxxvi, 9 and 12; lxxxviii, 2 [*Rosalina*, 1839].

DISCORBINA wrightii, Brady. Ann. Mag. Nat. Hist [5], VIII, 1881, 413. xxi, 6*a*, *b*, *c* [*Disc. parisiensis*, Wright (*pars*), 1877. Proc. Belfast Nat. F. C. 1876–77, app. 105, iv. 2*a*, *b*, *c*].

——— ——— ——— Brady, Denkschr. k. Ak. Wiss. Wien, XLIII, (2), 1882 [1881], 104, ii, 6*a*, *b*.

——— Wallich. North Atlantic Sea-bed, (1), 1862, no descr., ii, 4; and vi, 20 [structural].

——— Wallich. Deep Sea Researches, Biol. Globigerina, 1876, 1, etc., pl., 20 [structural].

——— Zittel. Handbuch Palæont. (1), 1876, 93, f 30².

——— K. Miller. Schr. Ver. Gesch. Bodensee, VII, 1877 [78], iv, 27 [error for 28]. [Cast or concretion.]

——— Nicholson. Manual Palæont. 1879, I, 101, f. 13, *c*.

——— Carpenter. Ency. Brit. ed. 9, IX, 1879, "Foraminifera," 374. i, 15.

——— (after Schultze's figures), Schlumberger. F. Jeun. Nat. Feb., 1882, ii, 8, 9; and March. 1882. iii, f 2.

——— Quenstedt. Handbuch Petref. ed. 3, (5), (1885), 1057, lxxxvi, 55.

——— de Folin. Le Naturaliste, Ann. 9, 1887, 139, f. 16.

——— see *Rotalites*.

DISCORBIS, Lamarck, 1804. See *Discorbites*.

——— **gervillii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 36 [given by d'Orbigny as a subgenus of *Rotalia*]

——— **lobatulus**, Macgillivray. Moll. Anim. Aberdeen, 1843, 34 [= *Truncatulina*].

——— **orbicularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 35.

——— **orbicularis**, Berthelin. Ann. Soc. Ac. Nantes, [5], VIII, 1878, 242, No. 63 [= *Discorbina*].

——— **parisiensis**, Berthelin. *Ibid.* [5], VIII, 1878, 243, No. 65 [= *Discorbina*].

——— **vesicularis** (Lamarck). Parkinson, Organ. Rem. former World, III, 1811, 159, xi, 1 [*Discorbites*, 1804].

——— ——— ——— Brown, Conch. Text-book, 1839, 61, x, 13.

——— ——— ——— Brown, Elem. Foss. Conch. 1843, 23, ii, 11.

——— Lyell. Elements Geology, 1838, 55, f. 22.

——— see *Rotalia*.

DISCORBITES, Lamarck, 1804. Ann. Mus. V, 1804. 183.

——— **vesicularis**, Lamarck. *Ibid.* V, 1804, 183; and f. 7, pl. 62, VIII, 1806 [v. *Discorbis*, *Discorbina* and *Rosalina*].

——— ——— ——— Lamarck, Velins du Muséum, Paris, v, 183. No. 22, f. 11, 12.

——— ——— ——— Lamarck, Ency. Méthod. (pls. 1827) (P. & J. quote (23), 1816); "Vers," II (1832), 90, 466–7 [= *Discorbina*].

——— ——— ——— Defrance, Dict. Sci. Nat. XIII, 1818, 346, xxii, 1821, 186; Atlas, Conch. xiv, 2.

——— ——— ——— Lamarck. Coq. Foss. Paris, 1823, 14, xiv, 7.

——— ——— ——— Bronn, Syst. urweltl. Conchyl. 1824, 7, i, 3*a*, *b*, *c*.

——— ——— ——— Defrance. Atlas Conch. xiii, 3; Blainville, Manuel Malac. et Conch. 1825 (pls. 1827) and 384, v, 3; vi, 2; [= ? *Dendritina* = *Peneroplis*].

——— ——— ——— Crouch, Introd. Lamarck, 1827, 41, xxii, 7.

——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, viii, 2.

——— Bowdich. Elements Conch. (1), 1822, 15, i. 5.

DISCORBULA, Lamarck, 1816.

——— **ariminensis**, Lam. Ency. Méth. pl. 466, f. 6*a*, *b* (P. & J. quote pt. 23, 1816), [*Rotalites discorbula*, 1804 = *Rotalia beccarii*].

DISCOSPORA, Morris, 1850, MS. Mantell, Pictorial Atlas of Org. Rem. 1850, 142 (note) [= *Assilina exponens*].

DORBIGNYÆA, Deshayes, 1830. Ency. Méth. "Vers," II, 1830; "Cephalopodes" [sign. F, f. 2], 231 and 234 [near *Rotalia*].

DUJARDINIA, Gray, 1858. Gray, Proc. Zool. Soc. XXVI, 1858, 270 [= *Carpenteria*].

——— **mediterranea**, Gray. *Ibid.* XXVI, 1858, 270, not figured.

DYOXEIA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 1881, 141, not described; two sp. proposed [v. *Dioxeia*].

ECHINITEN, Fichtel. Nachr. Verst. Siebenburgen, 1780, 78 [= *Alveolina*, fide Gümbel]

ECHINUS lobatulus, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microscope, 1798, 644, xiv, 46 [*E. subrotundatus*, W. & Boys = *Globig. bulloides*, v. *lobatula*, W & J.].

——— **subrotundatus planus lobatus**, Walker & Boys. Test. mim. rar. [1784], 25, iii, 89.

EGEON perforatus, Montfort. Conch. Syst. I, 1808, 167, 42 genre [= *Nummulites*].

EHRENBERGINA, Reuss, 1849. Denkschr. k. Ak. Wiss. Wien, I, 1850, 377; Brady, Report Challenger, 1884, 433.

——— **bicornis**, Brady. Quart. Journ. Geol. Soc. XLIV, 1888, 5, i, 3.

——— **hystrix**, Brady. Quart. Journ. Micr. Sci XXI, 1881, 60.

——— ——— Brady, Report Challenger, 1884, 434, lv, 8-11.

——— **pupa** (d'Orbigny). *Ibid.* 1884, 433, lv, 1*a*, *b*; cxiii 10*a*, *b*, *c* [*Cassidulina*, 1839].

——— **serrata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 377, xlviii, 7.

——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853-56, 231, xxxv², 25*a*, *b*, *c*.

——— ——— ——— Reuss' Model. No. 44, 1865 (Catal. No. 82, 1861).

——— ——— ——— Zittel, Handbuch Palæont. (1), 1876, 91, f. 29².

——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 68.

——— ——— ——— Brady, Report Challenger, 1884, 434, lv, 2-7.

EILEMAMMINA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 132, not described; three species proposed.

ELLIPSOIDINA, Seguenza, 1859. Eco Peloritano, [2], V, 1859, fasc. 9 [10]; Brady, Annals and Mag. Nat. Hist. [4], I, 1868, 337; and Brady, Report Challenger, 1884, 435.

——— **abbreviata**, Seguenza. *Ibid.* [2], V, 1859, fasc. 9, [14], pl., 5*a*, *b*.

——— **ellipsoides**, Seguenza. *Ibid.* [2], V, 1859, fasc. 9, [12], pl., 1-3.

——— ——— ——— Brady, Annals and Mag. Nat. Hist. [4], I, 1868, 338, xiii, 1-12.

——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 32.

——— ——— ——— var. **oblonga**, Seg. Brady, Quart. Journ. Geol. Soc. XLIV, 1888, 5, i, 1 [v. *E. oblonga*, Seg.].

——— **oblonga**, Seguenza Eco Peloritano, [2], V, 1859, fasc. 9, [13], pl., 4*a*, *b*.

ELLIPTINA, Hartwig, 1852. Verh. I Kl. Koninkl.-Nederland. Inst. [3], IV, 1852, 116 [= *Cenchridium* = *Lagena*].

——— **inflata**, Hartwig. *Ibid.* [3], IV, 1852, 116, ii, 9.

——— **truncata**, Hartwig. *Ibid.* [3], IV, 1852, 116, ii, 8.

ELPHIDIUM, Montfort. Conch. Syst. I, 1808, 15, 4 genre [= *Polystom. macella*].

ENCORYCIUM, Ehrenberg, 1858. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 11 and 19 [= *Nodosaria*].

——— **nodosaria**, Ehrenberg. *Ibid.* 1858, 19.

——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 13.

——— **terebra**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 20.

ENDOTHYRA, Phillips, 1846. Rept. Proc. Geol. Poly. Soc. W. R. Yorkshire, 1844-45 (1846), 277; Brady, Pal. Soc. XXX, 1876, 91

——— **ammonoides**, Brady. Mem. Geol. Surv. Scotland, Explan. Sheet 23, 1873, 63, 95, etc.

——— ——— ——— Brady, Carbonif. Foram. Pal. Soc. XXX, 1876, 94, v, 5, 6.

——— **baleyi**, Hall. Whitfield, Bull. Amer. Mus. Nat. Hist. I, No. 3, 1882, 42, ix, 34-36 [a misprint for *baileyi* = Hall's *Rotalia baileyi*, q. v.; considered by Whitfield as distinct from *E. bowmani*, Phil.].

——— **bowmani**, Phillips.

——— [**bowmanni**], Phillips. Rept. Proc. Geol. Poly. Soc. W. R. Yorkshire, 1844-45 (1846), 277, vii, 1 [f. 3 may also belong to *Endothyra*].

——— [**bowmanni**], ——— Brown, Elem. Foss. Conch. 1843, 17, vi, 2.

——— ——— ——— Brady, Carbonif. Foram. Pal. Soc. XXX, 1876, 92, v, 1-4.

——— [**bowmanni**], ——— v. Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], XXV, No. 9, 1878, 96, iv, 3*a*, *b*; xii, 2*a*, *b*.

——— ——— ——— Roemer, Lethæa Geognostica, (1), I, 1880, 281, f. 49.

ENDOTHYRA [**bowmanni**] Phillips. Prestwich, Geology, 1888, II, 101, f. 47c, d.
——— **circumplicata**, Howchin. Journ. R. Microsc. Soc. 1888, 541, viii, 10, 11.
——— **conspicua**, Howchin. Journ. R. Microsc. Soc. 1888, 540, ix, 12.
——— **crassa**, Brady. Carbonif. Foram. Pal. Soc. xxx, 1876, 97, v, 15–17 [*Involutina*, 1869].
——— ——— v. Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], xxv, No. 9, 1878, 93, iv, 2a–c; xii, 1a, b.
——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 211, ix, 16.
——— (cfr.) ——— ———. Steinmann, Zeitschr. deutsch. Geol. Ges. XXXII, 1880, 398, xix, 4.
——— ——— ——— Meunier, Bull. Soc. Hist. Nat. Autun, I, 1888, 235, vii, 9.
——— **cussyensis**, Meunier. *Ibid.* I, 1888, 235, vii, 6 and 10.
——— **globulus**, d'Eichwald. Brady, Carbonif. Foram. Pal. Soc. xxx, 1876, 95, v, 7–9 [*Nonionina globulus*, 1860].
——— ——— ——— v. Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], xxv, No. 9, 1878, 98, iv, 4a–c; xiii, 1–4.
——— ——— ——— v. Möller, *Ibid.* [7], XXVII, No. 5, 1879, 13 [f. 3 and 4]; 15, i, 1a–d, 2.
——— **macella**, Brady. Carbonif. Foram. Pal. Soc. xxx, 1876, 98, v, 13, 14 [*Involutina*, 1869].
——— **obliqua**, Brady. *Ibid.* xxx, 1876, 100, vi, 5, 6 [*Involutina*, 1869].
——— **ornata**, Brady. Mem. Geol. Surv. Scotland, Explan. Sheet, 23, 1873, 63, 95, etc.
——— ——— ——— Brady, Carbonif. Foram. Pal. Soc. xxx, 1876, 99, vi, 1–4.
——— ——— ——— v. **tenuis**, Brady. *Ibid.* xxx, 1876, 100, vi, 7, 8.
——— ——— ——— ——— v. Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], xxv, No. 9, 1878, 101, iv, 5.
——— **panderi**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 17, i, 3a–c.
——— **parva**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 18, i, 4; v, 1a, b.
——— **radiata**, Brady. Carbonif. Foram. Pal. Soc. xxx, 1876, 97, v, 10–12 [*Involutina*, 1869].
——— ——— ——— v. **tateana**, Howchin. Journ. R. Microsc. Soc. 1888, 542, ix, 13–15.
——— **radiifera**, Gümbel. Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver. Beilage, 1878, 105, f. 25^{18}.
——— **simplex**, Gümbel. *Ibid.* 1878, 105, f. 25^{19}.
——— **subtilissima**, Brady. Carbonif. Foram. Pal. Soc. xxx, 1876, 101, vi, 9.
——— ——— ——— Roemer, Lethæa Geognostica, (1), I, 1880, 282, f. 50.
——— sp. Schwager. Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 93.
——— sp. ind. v. Möller. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 18, vii, 6.
——— Nicholson. Manual Palæont. 1879, I, 111, f. 20.
——— Sorby. Quart. Journ. Geol. Soc. xxxv, 1879, address, pl. (privately printed), xviii [section of carboniferous limestone].
——— Neumayr. Stämme d. Thier-reiches, I, 1889 (8), 185, f. 26.

ENODOTHYRA, Venyukov, 1888, misprint for *Endothyra*.

ENTOSALENIA, Parker & Jones, 1857. Annals Mag. Nat. Hist. (2), XIX, 1857, 278, etc. [error for *Entosolenia*].

ENTOSOLENIA, Ehrenberg, MS. Williamson, Annals Mag. Nat. Hist. [2], I, 1848, 5.

Williamson says:—"A little time after making this discovery (the entosolenian tube), I received from Dr. Bailey of New York, specimens of *Lagena striata* (which is one of those having an external tube) and attached to it was the name of *Miliola ficus*, which name had been given to it by M. Ehrenberg. Along with these were specimens of *Lagena globosa* (one of the species characterized by an *internal* tube) to which was affixed by Ehrenberg the very expressive name of *Entosolenia miliaris*? Hence it was evident that the great Prussian naturalist had observed the same peculiarity of structure in the species exhibiting the internal tube and had given to the objects characterized by it the very expressive name of *Entosolenia*, which name it is my intention to retain, in separating the existing genus *Lagena* into two distinct groups."

ENTOSOLENIA alata, Möbius. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 89, viii, 5.

—— **aspera**, Reuss. Möbius, *Ibid.* 1880, 91, viii, 11, 12 [*Lagena*, 1861 = *Lagena*].

—— **costata**, Williamson. Recent British Foram. 1858, 9, i, 18 [v. *Lagena* and *Lagenulina*].

—— —— —— Dawson, Canad. Nat. IV, 1859, 29, f. 6 and 7.

—— —— —— Dawson, *Ibid.* VI, 1872, 254, iii, 2.

—— —— —— Dawson, Handbook Zoology, ed. 3, 1886, 43, f. 32.

—— **globosa**, Walker & Jacob. Williamson, Annals & Mag. Nat. Hist. [2], I, 1848, 16, ii, 13 and 14 [v. *Lagena*].

—— —— —— Williamson, Recent British Foram. 1858, 8, i, 15 and 16.

—— —— —— v. **lineata**, Williamson. *Ibid.* 1858, 9, i, 17 [= *Lagena caudata*, d'Orb.].

—— —— —— var. Parker & Jones. Annals Mag. N. H. (2), XIX, 1857, 279, xi, 25–29 [25, *L. squamosa;* 26, *L. catenulata;* 27, *L. striata;* 28, 29, *L. marginata*].

—— —— —— Dawson, Canad. Nat. IV, 1859, 28. f. 4 and 5.

—— —— —— Cooke, Thousand Objects Microsc. 1869, 91, ix, 15; and fragment, 19, iv, 1.

—— —— —— Chimmo, Bed of Atlantic, 1870, 18, iii, 1 [ribbed, with tuberculated interspaces].

—— —— —— Dawson, Canad. Nat. VI, 1872, 254, iii, 2.

—— —— [Will.]. Schulze, Arch. mikrosk. Anat. XIII, 1877, 9, etc., ii, 1–3 [structural].

—— —— —— Jones. In Microgr. Dict. ed. 4, 1883, 290, xxiii, 23*a*, *b*.

—— —— —— Dawson, Handbook Zoology, ed. 3, 1886, 43, f. 31.

—— **lineata**, Williamson. Annals Mag. Nat. Hist. [2], I, 1848, 18, ii, 18 [v. *Lagena*].

—— —— —— Gosse, Manual Mar. Zool. 1855, 11, f. 10.

—— **lucida**, Will. Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 89, viii, 4 [*marginata*, var., 1848; v. also *Lagena*].

—— **marginata** (Walker & Boys). Williamson, Annals and Mag. Nat. Hist. [2], I, 1848, 17, ii, 15 and 16 [*Serpula*, 1784].

—— —— —— v. **lucida**, Will. Williamson, *Ibid.* [2], I, 1848, 17, ii, 17.

—— **marginata**, Montagu. Williamson, Recent British Foram. 1858, 9, i, 19–28; "19–21 typica" ['*not* Walker; his figure is a *miliola*"] [v. *Lagena*].

—— —— —— v. **lagenoides**, Williamson. *Ibid.* 1858, 11, i, 25 and 26.

—— —— —— v. **lucida**, Williamson. *Ibid.* 1858, 10, i, 22 and 23.

—— —— —— v. **ornata**, Williamson. *Ibid.* 1858, 11, i, 24.

—— —— —— v. **quadrata**, Williamson. *Ibid.* 1858, 11, i, 27 and 28.

—— —— —— Dawson, Canad. Nat. n. s. v, 1870, 177, f. 12.

—— **(Lag.)** —— —— Chimmo, Bed of Atlantic, 1870, 18, iii, 3 ("*Lagena vulgaris, Substriata marginata*," said to have *siliceous* margin).

—— —— —— Chimmo, *Ibid.* 1870, 27, x, 1.

—— —— —— Dawson, Amer. Journ. Sci. [3], I, 1871, 206, f. 12; and Annals Mag. N. H. [4], VII, 1871, 86, f. 12 [*Lag. gracillima*, Seg.].

—— —— —— Chimmo, Nat. Hist Euplectella, etc. 1878, 21, vi, 20*a*, *b*, *c*, *d* [= *Lagena seminiformis?*. Schw.].

—— —— [Walker]. Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 90, viii, 7 and 8.

—— **miliaris**, Ehr., 1839. See Williamson, Annals Mag. Nat. Hist. [2], I, 1848, 5.

—— **perforata**, Möbius. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 90, viii, 6.

—— **quadrata**, Williamson. Chimmo, Bed of Atlantic, 1870, 28, x, 2 [v. *E. marginata* and *Lagena*].

—— —— —— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 90, viii, 9.

—— **rudis**, Reuss. Möbius, *Ibid.* 1880, 90, viii, 10.

—— **squamosa**, Montagu. Williamson, Annals and Mag. Nat. Hist. [2], I, 1848, 18, ii, 19 [*Vermiculum*, 1803].

—— —— —— var. *a*, **catenulata**, Jeff. *Ibid.* [2], I, 1848, 19, ii, 20.

EPISTOMINA irregularis, Terquem. Terquem, Mém. Soc. Géol. France, IV, 1886, 54, vi, 10–17.

——— **mosquensis**, Uhlig. Jahrb k. k. geol. Reichs. XXXIII, 1883, 766, vii, 1–3.

——— **nuda**, Terquem. Cinquième Mém. Foram. Oolithique, 1883, 376, xliii, 1*a*, *b*, *c*, 2*a*, *b*.

——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 51, v, 17*a*, *b*, *c*.

——— **ornata**, Terquem. Cinquième Mém. Foram. Oolithique, 1883, 377, xliii, 7 and 8.

——— ——— ——— Terquem, Mém. Soc. Géol France, [3], IV, 1886, 53, vi, 7-9.

——— **partschi** (d'Orbigny). Uhlig, Jahrb. k. k. geol. Reichs. XXXIII, 1883, 763, ix, 6 and 7 [*Rotalina*, 1846].

——— **regularis**, Terquem. Cinquième Mém. Foram. Oolithique, 1883, 379, xliv, 1–3.

——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 55, vi, 18–21.

——— **reticulata** (Reuss). Uhlig, Jahrb. k. k. geol. Reichs. XXXIII, 1883, 768, vii, 8–9 [*Rotalia*, 1862].

——— **spinulifera** (Reuss). *Ibid.* XXXIII, 1883, 768, vii, 5–7 [*Rotalia*, 1862].

——— **stelligera** (Reuss). *Ibid.* XXXIII, 1883, 770, vii, 10 and viii, 1–3 [*Rotalina*, 1854].

EPONIDES repandus, Montfort. Conch. Syst. I, 1808, 127, 32 genre [= *Pulvinulina*].

"**ETOILES marinis**," Knorr. Rec. de Monumens, III, 1775, 158, vi*, 8–16 [= *Siderolina calcitrapoides*].

FABULARIA, Defrance, 1820. Dict. Sci. Nat. XVI, 1820, 103.

——— **compressa**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 409, No. 1354.

——— **discolithus**, Defrance. Dict. Sci. Nat. XVI, 1820, 103; Atlas Zooph. xlviii, 5.

——— [**discolites**], ——— Bronn, Syst. urweltl. Pflanzen-thiere, 1825, 29, vii, 13*a*–*c*.

——— [**discolithes**] ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 307, No. 1, xvii, 14–17.

——— [**discolithes**] ——— D'Orbigny, Modèles, No. 100, 1826.

——— ——— ——— Blainville, Actinol. 1834, lxxiii, 5.

——— [**discolithes**] ——— Cuvier, Règne Animal, 1836–46, IX, (pls. x), 35, xiv, 4.

——— [**discolithes**] ——— Bronn, Lethæa Geognostica, ed. 2, 1837, 1149, xlii, 35 and 36 [36 error].

——— [**discolithes**] ——— Smedley, Ency. Metrop. 1845, undescr., pl., "Mollusca?" 39–41.

——— [**discolithes**] ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 267, xxi, 55 and 56.

——— [**discolithes**] ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 198, xlii, 35.

——— [**discolithes**] ——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 69, vi, 2*a*, *b*, *c*, *d*.

——— [**discolithes**] ——— Carpenter, Parker & Jones, Introd. Foram. 1862, 82, vi, 37 and 38 [structural].

——— [**discolithes**] ——— Reuss' Model. 1865, No. 12 (Catal. 1861), No. 21.

——— [**discolithes**] ——— P., J. & B. [d'O., Modèles 100] Ann. Mag. Nat. Hist. [3], XVI, 1865, 35, i, 16 [= *F. ovata*, Roissy].

——— [**discolithes**] ——— Figuier, Ocean World, [1873], 82, f. 14.

——— [**discolithes**] ——— Zittel, Handbuch Palæont. (1), 1876, 79, f. 13[1].

——— [**discolithes**] ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl., 117.

——— [**discolithes**] ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 190, viii, 2.

——— [**discolithes**] ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 161, xvi (xxiv), 31*a*, *b*.

FISSURINA alata, Reuss. Zeitschr. deutsch. geol. Ges. 1851, 58, iii, 1.
——— ——— ——— Pictet, Traite de Paleont. ed. 2, IV, 1857, 483, cix, 3.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 339, vii, 87.
——— ——— ——— Franzenau, Math. termész. értesito, VII. 1889. 249, v, 4.
——— **aperta,** Seguenza. Foram. monotal. miocen. Messina, 1862, 60, i, 60 [= *L. marginata*, W. & I.].
——— **apiculata,** Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 339, vi, 85 [*Oolina*, 1850].
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 30, i (ix), 18.
——— **aradasii,** Seguenza. Foram. monotal. miocen. Messina, 1862, 58, i, 59 [= *L. marginata*, W. & I.].
——— **benoitiana,** Seguenza. *Ibid.* 1862, 62, ii, 11 [= *L. marginata*, W. & I.].
——— **biancæ,** Seguenza. *Ibid.* 1862, 57, i, 48–50.
——— **bicarinata,** Terquem. Mém. Soc. Géol France, [3], II, 1882, 31, i (ix), 24*a*, *b* [v. *Lagena*].
——— **bicaudata,** Seguenza. Foram. monotal. miocen. Messina, 1862, 64, ii, 16 [*L. marginata*, W. & I., var. *bicaudata*, Seg.].
——— **bouei,** Karrer. Abh. k. k. geol. Reichs. IX, 1877, 378, xvi*b*, 19.
——— **capillosa,** Schwager. Novara-Exped. Geol. (2), 1866, 210, v, 25.
——— **carinata,** Reuss. Sitz. k. Ak. Wiss. Wien, XLVI (1), 1862 (1863), 338, vi, 83; vii, 86.
——— ——— ——— Reuss' Model, 1865, No. 17 (Catal. 1861, No. 35) [= *Lag. marginata*, Mont.].
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, (2), 1876, 68, vii, 10*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 2.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 31, i (ix), 23*a*, *b*.
——— **cincta,** Seguenza. Foram. monotal. miocen. Messina, 1862, 67, ii, 31.
——— **circulum,** Seguenza. *Ibid.* 1862, 63, ii, 15 [= *L. marginata*, W. & I.].
——— **communis,** Seguenza. *Ibid.* 1862, 58, i, 56 and 57 [= *L. marginata*, W. & I.].
——— **costæ,** Seguenza. *Ibid.* 1862, 69, ii, 38 [= *L. marginata*, W. & I.].
——— **crenata,** Seguenza. *Ibid.* 1862, 67, ii, 32 [not *Lagena crenata*, P. & J.].
——— **deltoidea,** Seguenza. *Ibid.* 1862, 57, i, 45 [= *L. marginata*, W. & I.].
——— **dentata,** Seguenza. *Ibid.* 1862, 58, i, 55.
——— **dilatata,** Seguenza. *Ibid.* 1862, 65, ii, 21 [= *L. marginata*, W. & I.].
——— **diptera,** Seguenza. Atti R Acc. Lincei, [3], VI, 1880, 332, xvii, 36.
——— **echinata,** Seguenza. Foram. monotal. miocen. Messina, 1862, 58, i, 54.
——— **ehrenbergii,** Seguenza. *Ibid.* 1862, 62, ii, 8 [= *L. marginata*, W. & I.].
——— **elegans,** Seguenza. *Ibid.* 1862, 69, ii, 39 [= *L. marginata*, W. & I.].
——— **elliptica,** Seguenza. *Ibid.* 1862, 60, ii, 3 [= *L. marginata*, W. & I.].
——— **emarginata,** Seguenza. *Ibid.* 1862, 65, ii, 20 [= *L. marginata*, W. & I.].
——— **foliacea,** Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 306, xvii, 13, 13*a*.
——— **gemellarii,** Seguenza. Foram. monotal. miocen. Messina, 1862, 70, ii, 45.
——— **globosa,** Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 317, xii, 4 [not *Lagena globosa* (Montagu)].
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 339, vii, 88.
——— **haeckelii.** Seguenza. Foram. monotal. miocen. Messina, 1862, 63, ii, 13 [= *L. marginata*, W. & I.].
——— **inæqualis,** Seguenza. *Ibid.* 1862, 63, ii, 14 [= *L. marginata*, W. & I.].
——— **lævigata,** Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 366, xlvi, 1 [v. *Lagena*].
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 242, xxxv[3], 4*a*, *b*.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 338, vi, 84.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 30, i (ix), 17*a*, *b*.

FISSURINA tricuspidata, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, (1), 1870, 470; figured by v. Schlicht "Foram. Septar. Pietzpuhl," 1870, v, 16–18.
——— **tubulosa**, Seguenza. Foram. monotal. miocen. Messina, 1862, 68, ii, 36 and 37 [= *L. marginata*, W. & I.].
——— **zanclea**, Seguenza. *Ibid.* 1862, 61, ii, 5 [= *L. marginata*, W. & I.].
——— v. Schlicht. "Foram. Septar Pietzpuhl," 1870, plates iv, v.
FLABELLINA, d'Orbigny, 1835 (1839). De la Sagra's Hist. phisiq., etc., Cuba, 1839, "Foraminifères," 42.
——— **agglutinans**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 333, xxiv, 23*a*, *b*, 24.
——— **ambigua**, Terquem. Sixième Mém. Foram. Lias, 1866, 519, xxii, 13*a*, *b*.
——— **anceps**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 325, xxiii, 25*a*, *b* [*cf. Cristell. anceps*].
——— ——— ——— Terquem, Cinquième Mém. Foram. Oolithique, 1883, 348, xxxviii, 13.
——— **anomala**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 329, xxiv, 12*a*, *b* [*cf. Crist. anomala*].
——— **baudouinana**, d'Orbigny. Mém. Soc. Géol. France, (1), IV, 1840, 24, ii, 8–11; and Facsimile in Science Gossip, 1870, 106, f. 104.
——— ——— ——— Reuss, Verstein. Böhm. Kreide, 1845–6, I, 32, viii, 36.
——— **[baudouiniana]**, ——— Bronn, Lethæa Geognostica, ed. 3, II, 1851–52, 82, xxix[1], 20.
——— **[baudouiana]**, ——— Jones, Lecture Geol. Hist. Newbury, 1854, 48, ii, 55*a*.
——— **[baudouina]**, ——— Mantell, Medals Creation, ed. 2, 1854, 347, f. 111, 4*a*, *b*.
——— **bicostata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863 427, x, 14.
——— **budensis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 37, iv, 17; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 44, same pl. and fig.
——— **carinata**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xx, 10.
——— **cenomana**, d'Orbigny, 1847. D'Orbigny, Prodrome de Paléont. ii, 1850, 185, No. 753.
——— **centralis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 332, xxiv, 22*a*, *b* [*cf. Crist. centralis*].
——— ——— ——— Terquem, Bull. Soc. géol. France, [3], IV, 1876, 492, xvi, 22.
——— ——— ——— Terquem, Cinquième Mém. Foram. Oolithique, 1883, 348, xxxviii, 14.
——— **centro-gyrata**, Terquem. Mém. Ac. Imp. Me z, LI, 1870, 332, xxiv, 21 [*cf. Crist. centro-gyrata*].
——— **clathrata**, Terquem. *Ibid.* XLIV, 1863 429, x, 8 [18] *a*, *b*.
——— **condata**, Reuss. Neues jahrb. 1849, 839, error for *F. cordata*.
——— **cordata**, Reuss. Geogn. Skizze Böhmen, II, 1844, (1), 213.
——— ——— ——— Reuss, Verstein. Böhm. Kreide, 1845–6, i, 32, viii, 37–46, 78.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein 1845–46, 659, xxiv, 25.
——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, VII, (1), 1854, 67, xxv, 6*a*, *b*, 7, 8.
——— ——— ——— Carpenter, Parker & Jones, Introd. Foram. 1862, xii, 6.
——— ——— ——— Reuss' Model No. 24, 1865 (Catal. No. 54, 1861 [= *F. oblonga*, v. M.].
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 30.
——— ——— ——— Bütschli, in Bronn, Klassen, etc., Thier-Reichs, 1880, 198, vii, 26.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, (5), (1885), 1052, lxxxvi, 19 and 20.
——— ——— ——— Prestwich, Geology, 1888, II, 290, 151*a*.
——— **cristellarioides**, Karrer. Abh. k. k. Geol. Reichs. IX, 1877, 381, xvi*b*, 31.
——— **cuneata**, v. Münster. Reuss, Neues Jahrbuch, 1849, 839, x, 26 [*Frondiculina*, 1838].

FLABELLINA cuneata, v. Münster. Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 231, ii, 29.
——— ——— ——— Reuss, *Ibid.* L, (1), 1864 (1865), 460, ii, 8.
——— ——— ——— Brady, Q. Journ. Micr. Sci. XIX, 1879, 271, viii, 7.
——— **cuneiformis**, Terquem. Sixième Mém. Foram. Lias, 1866, 522, xxii, 17*a*, *b*, 18*a*, *b*, 19.
——— **deslongchampsi**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 426, x, 13.
——— **disparilis**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 490, xvi, 17.
——— **dubia**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 333, xxiv, 25*a*, *b*, 26.
——— **eichbergensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 22, ii, Ornatenthon 5.
——— **elliptica**, Nilsson. Fric, Stud. Gebiete Böhmischen Kreideform. II, 1877, 149, f. 152 [*Planularia*, 1825].
——— ——— ——— Fric, Arch. Nat. Landesd. Böhmens, VII, 1889, 114, woodcut 160.
——— **ensiformis** (Röm.). Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 229, ii, 23–24 [*Frondiculina*, 1838].
——— ——— ——— Reuss, *Ibid.* L, (1), 1864 (1865), 460, v, 2.
——— **excavata**, Terquem. Ess. Anim. Plage Dunkerque, (3), 1881, 116, xiii, 20*a*, *b* (and Mém. Soc. Dunkerquoise).
——— **ferruginea**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 491, xvi, 18 and 19.
——— **flouesti**, Terquem. Cinquième Mém. Foram. Lias, 1866, 443, xviii, 13*a*, *b*.
——— **foliacea**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 271, viii, 8–10.
——— **gyrata**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 322, xxiii, 17*a*, *b*.
——— **harpa** (Batsch.), v. *Nautilus*.
——— **hortensis**, Terquem. Sixième Mém. Foram. Lias, 1866, 521, xxii, 16*a*, *b*.
——— **hybrida**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 330, xxiv, 16.
——— **inæquilateralis**, Terquem. *Ibid.* XLIV, 1863, 428, x, 16*a*, *b*.
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——— **insignis**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 40, iii (xiii), 12*a*–*c*.
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——— **subfalcata**, Costa. *Ibid.* ii, 1855 (1857), 372, iii, 17.
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——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 469, xix, 23.
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——— **tricostulata**, Reuss. Denkschr. k. Ak. Wiss. Wien, i, 1850, 368, xlvi, 12.
——— **tricuspis**, Reuss. *Ibid.* i, 1850, 368, xlvi, 13.
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——— **trisulca**, Reuss. Verstein. Böhm. Kreide, 1845–6, i, 30, viii, 22.
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——— **2 speciei**, Soldani. *Ibid.* 1780, 110, viii, 48, *H* and *I* [= *Quinqueloc. secans*, var.].

——— **3 speciei**, Soldani. *Ibid.* 1780, 110, viii, 49, *K* to *P* [*K* = *Triloc. carinata; L, M* = *Miliol. seminulum; N* = *Mil. cor-anguinum; O, P* = *Adelosina pulchella*].

——— **4 speciei**, Soldani. *Ibid.* 1780, 110, ix, 50, *Q* [= *Cornuspira foliacea*].

——— **5 speciei**, Soldani. *Ibid.* 1780, 111, ix, 51, *R* and *S* [=*Biloc. bulloides*].

——— **6 speciei**, Soldani. *Ibid.* 1780, 111, ix, 52, *T* and *V* [= *Spiroloc. depressa*].

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——— **bocki**, v. Müller. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXV, No. 9, 1878, 54, i, 3*a–g;* vii, 2*a*, *b*.

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——— **cicer**, Stache. *Ibid.* XXIV, 1874, 172.

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——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 214, xii, 12, 13 and 15.
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——— ——— ——— Brady, Ann. Mag. Nat. Hist. [4], XVIII, 1876, 417, xviii, 5 (and 6?).
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——— **rhombica**, Stache. Jahrb. k. k. geol. Reichs. XXIV, 1874, 172.
——— **robusta**, Meek. Geol. Surv. California, Palæont. I, 1864, 3, ii, 3 and 3*a*, *b*, *c*.
——— **rotkyana**, Stache. Jahrb. k. k. geol. Reichs. XXIV, 1874, 172.
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——— **uralica**, Krotov. Trudye geol. Kom. (St. Petersburg), VI, No. 1, 1888, 435 and 551, ii, 2–6.
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——— **crassa**, v. Möller. *Ibid.* [7], XXVII, No. 5, 1879, 25, iii, 2*a*, *b*.
——— **sphærica**, Abich. v. Möller, *Ibid.* [7], xxv, No. 9, 1878, 114, v, 6*a–d*; xv, 3*a*, *b* [*Fusulina*, 1859].
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——— ——— ——— var. **chilostoma**, Rss. *Ibid.* XII, (7), 1888, 219, xlii, 9 [*Textilaria*, 1852].
——— **reussi**, Stache. Novara-Exped., Geol. (1), 1864, 171, xxi, 11*a*–*d*.
——— **reussi**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 83, i. 2*a*, *b*.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 11, i, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 14, same pl. and fig.
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——— ——— ——— Reuss in Geinitz. Grundr. Verstein. 1845–46, 667, xxiv, 69.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII. 1856, 244, v, 61.
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——— **scabra**. Brady. Report Challenger, 1884, 381, xlvi, 7*a*, *b*.
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——— **spissa**, Berthelin. Mém. Soc. Géol. France, [3], I, 1880, 24, i (xxiv), 7*a*–*d*.
——— **subglabra**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 602, i, 4*a*, *b*.
——— **subrotundata**, Schwager. Novara-Exped., Geol. (2), 1866, 198, iv, 9*a*, *b*, *c*.

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—— **conica**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 435, v, 10*a*, *b*.
—— **costata**, Bornemann. Lias von Göttingen, 1854, 34, ii, 11*a*, *b*.
—— **costata**, Terquem. Sixième Mém. Foram. Lias, 1866, 479, xix, 12*a*, *b*.
—— **crassa**, Dunikowski. Kosmos [Lemberg], IV, 1879, 122, plate, 14.
—— **cuneiformis**, Terquem. Sixième Mém. Foram. Lias, 1866, 478, xix, 7.
—— —— —— Tate & Blake, Yorkshire Lias, 1876, 454, xviii, 12.
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—— **cylindrica**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. I, 1850, 53, i, 10 [= *discreta*, Reuss, Neugeb., 1860].
—— **deformis**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 129, xi, 16–18 and 26.
—— **discreta**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 366, xlvi, 3.
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——— **cretæ**, Ehrenberg. Mikrogeologie, 1854, xxvii, 59 ("*Gl. bulloides ?* 1838") [= *G. cretacea*].
——— ———? ——— *Ibid.* 1854, xxvi, 44 ("*Rosal. foveolata*, 1838") [= *G. bulloides*].
——— ——— ——— *Ibid.* 1854, xxx, 38 [= *G. cretacea*, d'O.].
——— ——— ——— *Ibid.* 1854, xxiii, 33 and 34 [= *Glob. bulloides*] [called elsewhere *Rosal. foveolata*].
——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 277, No. 9.
——— **depressa**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 92; and Mikrogeologie, 1854, xix, 92 [= *G. bulloides*].
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——— **digitata**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 72.
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——— ——— ——— Terrigi, Mem. R. Acc. Lincei, (4), VI. 1889, 113, vi, 13.
——— **diplostoma**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 373, xlvii, 9 and 10; xlviii, 1.
——— **dubia**, Egger. Neues Jahrbuch, 1857, 281, ix, 7–9.
——— ——— ——— Brady, Report Challenger, 1884, 595, lxxix, 17*a*, *b*, *c*.
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——— **elevata**, d'Orbigny. Mém. Soc. Géol. France, [1], IV, 1840, 34, iii, 15 and 16; Facsimile in Science Gossip, 1870, 108, f. 119.
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——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 277, No. 4.
——— ——— ——— = *Cassidulina oblonga* (d'O.), see *Polymorpha tuberosa* et *globifera*.
——— **eocæna**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 662, ii, 109*a*, *b*.

GLOBIGERINA (Orbulina) neojurensis, Karrer. Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 186, i, 16 [*Orbulina*, 1867].
——— **nereidum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 282.
——— **oblonga**, d'Orb. Ann. Sci. Nat. VII, 1826, 277, No. 4.
——— **omphaloletras**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 282.
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——— **oolithica**, Terquem. Cinquième Mém. Foram. Oolithique, 1883, 365, xli, 11*a*, *b*.
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——— **ovoidea**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 228, xvii, 39.
——— **pachyderma** (Ehr.). Brady, Report Challenger, 1884, 600, cxiv, 19 and 20 [*Aristerospira*, 1861].
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——— **pentatrias**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 282.
——— **(Orbulina) porosa**, Terq. Terrigi, Mem. R. Acc. Lincei, (4), VI, 1889, vi, 18 [*Orbulina*, 1884, *Globulina*, 1858].
——— **punctulata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 277, No. 8.
——— **quadrilobata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 164, ix, 7–10.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, 242, xxi, 3 and 4 [error for 5].
——— **regularis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 162, ix, 1–3.
——— ——— ——— var. Reuss, Denkschr. k. Ak. Wiss. Wien, I, 1850, 373, xlvii, 7.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, 240, xx [error for xxi], 3*A*, *B*.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 187, i, 19.
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——— **regularis**, Terquem. Ess. Anim. Plage Dunkerque, (3), 1881, 125, xvi, 2*a*, *b*. (& Mém. Soc. Dunkerquoise).
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——— **rotundata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 277, No. 6.
——— **rubra**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 82, iv, 12–14; also in Spanish, 1840, 94, same pl. and fig.
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——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 225, xlv, 12.
——— **rubra**, Ehrenberg, 1857 = ***Pylodexia rubra.*** Monatsber. k. preuss. Ak. Wiss. Berlin, 1872, 282.
——— **sacculifera**, Brady. Geol. Mag. (2), IV, 1877, 535 [not figured].
——— ——— ——— Brady, Report Challenger, 1884, 604, lxxx, 11–17; lxxxii, 4.
——— **seminulina**, Schwager. Novara-Exped., Geol. (2), 1866, 256, vii, 112.
——— **siphonifera**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 83, iv, 15–18; also in Spanish, 1840, 95, same pl. and fig.
——— **spirata**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 342, xvi, 9.
——— **stellata**, Ehrenberg. Mikrogeologie, 1854, xxvi, 45 ["compare *G. libani*"] [=*G. bulloides*].
——— **taminensis**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 24, iii, 26 and 29; and section of the shell, x, 600 [= *G. bulloides*].
——— **ternata**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 247.
——— ——— ——— Ehrenberg, Mikrogeologie, 1854, XXXV, *B*, iv, 5 and 6 [= *Globig. bulloides*].
——— **trifoliata**. K. Miller. Schr. Ver. Gesch. Bodensee, VII, 1877 [78], iv, 24 [cast or concretion ?].

GLOBIGERINA, Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 201, vii, 29.
——— Schacko, Arch. f. Naturgesch. (Wiegmann's), 1883 (49th Jahrg.), I, 429, etc., xiii, 2–6.
——— sp. Schwager, Palæontographica, xxx, 1883, Pal. Theil, 118, xxvii, (4), 6*a–d*.
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———? (hispid. var). See *Sphærulæ hispidæ*.
GLOBULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 266 [given by d'Orbigny as a subgenus of *Polymorphina*].
——— **acuta**, Römer? Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 245, vi, 62 [*Polymorphina*, 1838].
——— **æqualis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 227, xiii, 11, 12 [v. *Polymorphina*].
——— ——— ——— Reuss' Model. No. 52, 1865 (Catal. No. 69, 1861).
——— **amplectens**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 81, vi, 44.
——— ——— ——— Bornemann, Zeitschr. deutsch. geol. Ges. XII, 1860, 160, vi, 12*a*, *b*, *c*.
——— **amygdaloides**, Reuss. *Ibid.* III, 1851, 82, vi, 47 [v. *Polymorphina lactea*, var.].
——— **asperula**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 646, ii, 81*a*, *b*.
——— **australis**, d'Orbigny. Voyage Amér. Mérid. 1839, v, (5), "Foraminifères," 60, i, 1–4 [v. *Polymorphina*].
——— **bulloides**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 318, iii, 4.
——— **caribæa**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 135, ii, 7 and 8; also in Spanish 1840, 130, same pl. and fig.
——— **cordiformis**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 277, xviii, 19*a*, *A*, *B*.
——— **deformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 27.
——— **depressa**, d'Orbigny. *Ibid.* VII, 1826, 267, No. 26.
——— ——— ——— Terq., Mém. Soc. Géol. France, [3], II, 1882, 131, xiii (xxi), 28-30.
——— **discreta**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 378, xlviii, 10.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, L, (1), 1864 (1865), 468, iii, 3*a*, *b*.
——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 24.
———(?) **fragraria**, Gümbel. Sitz. k.-bayer. Ak. Wiss. I, 1871, 68, i, 16.
——— **gibba**, d'Orbigny. Ann. Sci. Nat VII, 1826, No. 20, 267; and Modèles, No. 63 [*Polymorpha* (*Globulina*), 1826].
——— ——— ——— Reuss in Geinitz, Grundr. Verstein. 1845–46, 669, xxiv, 84.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 227, xiii, 13 and 14.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853-56, 232, xxxv², 28*a*, *b*.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, (1), 1875, 37, v, 15; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], I, 1878, 43, iv (ix), 1-5.
——— ——— ——— *Ibid.* [3], II, 1882, 130, xiii (xxi), 22–27.
——— **globosa**, Münst. Reuss in Geinitz, Grundr. Verstein. 1845–46, 669, xxiv, 85 [*Polymorphina*, 1838].
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 318, iii, 3.
——— **grateloupi**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 23.
——— **guttula**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 82, vi, 46 [v. *Polymorphina*].
——— ——— ——— Pictet, Traité de Paléont. 2 ed., IV, 1857, 518, cix, 38.

GLOBULINA subgibba, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 645, ii, 79.
——— **sulcata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 266, No. 21 [= *Polymorphina myristiformis*, Will., *fide* Fischer].
——— **translucida**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 25.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 131, xiii (xxi), 31*a*, *b*.
——— **transversa**, Terquem. *Ibid.* [3], II, 1882, 129, xiii (xxi), 17–21.
——— **tuberculata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 230, xiii, 21 and 22 [v. *Polymorphina*].
——— ——— ——— Terq., Mém. Soc. Géol. France, [3], II, 1882, 132, xiii (xxi), 33 and 34.
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——— **tubulosa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 228, xiii, 15 and 16 [v. *Polymorphina lactea*, var., and *Polymorphina*.]
——— ——— ——— B., P. & J., Trans. Linn. Soc. XXVII, 1870, 246, xlii, 38*b*.
——— **turbinata**, Terquem. Mém. Soc. Géol. France, [3], I, 1878, 43, iv (ix), 6–8.
——— **unilocularis**, Terquem. *Ibid.* [3], II, 1882, 128, xiii (xxi), 8.
——— **varians**, Terquem. *Ibid.* [3], II, 1882, 128, xiii (xxi), 9–16.
——— sp. Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 137, vii, 6, 7 and 25.
——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, n. d., xxii, 11.
——— d'O., v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, plates xxvi and xxvii.
GLOBULINA-like forms. Gümbel, Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 235, iv, 21 [= ? *Oolitic concretions*].
GLOBULINA, Deshayes. Ency. Méth. "Vers" II, 1830, "Cephalopodes" [Sign. *Ff* 2], 234. [The "7th Fam." of Deshayes' "Tableau" containing the proposed genera "Spirosphérine" and "Polysphérine."
GLOBULNIA [Costa], see *Globulina*, Costa. Atti Accad. Pontaniana, VII, (2), 1856.
GLOMOSPIRA, Rzehak. See *Ammodiscus gordialis*.
GONIOLINA, d'Orbigny, 1847. [" Fruit agrégé d'une Spadiciflore jurassique, ... l'affinité avec les Pandanées." Saporta & Marion, Comptes-Rendus, XCII, 1881, 1268.
——— **hexagona**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 41, No. 622.
——— 2 sp. Buvignier, Stat. géol. etc., Meuse, 1852, Atlas, 47, pl. xxxii.
GRAMMOBOTRYS, Ehrenberg, 1845.
——— **africana**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 368.
——— **anglica**, Ehr. Mikrogeologie, 1854, xxviii, 32 [= *Virg. hemprichii*].
? ——— **parisiensis**, Ehr. *Ibid.* 1854, xxvii, 30 and 31 [= *Sphæroid. bulloides*].
——— Ehrenberg, see *Textularia*.
GRAMMOSTOMUM, Ehrenberg, 1838. Abhandl. k. Ak. Wiss. Wien, Berlin, 1838 (1840), 119.
——— **aciculatum**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844; and Mikrogeologie, 1854, xxi, 85 [*Boliv. punctata*].
——— ——— ——— Mikrogeologie, 1854, xx, ii, 10 ("*Textil. aciculata*, 1838") [= *Boliv. dilatata*, Reuss].
——— **aculeatum**, Ehr. *Ibid.* 1854, xxxv, *B*, iv, *A*, *p* [= *Vulvul. aculeata* (Ehr.)].
——— ——— ——— *Ibid.* 1854, xxviii, 17 [near *Verneuil. spinulosa*, Reuss].
——— ——— ——— *Ibid.* 1854, xxx, 13 ("*Textil. spinosa*, 1838, partly") [*T. subangulata*, d'O. ; compare *T. mariæ*].
——— **ægyptiacum**, Ehr. *Ibid.* 1854, xxiii, 9 and 10.
——— **americanum**, Ehr. *Ibid.* 1854, xxxii, i, 11 [= *Virg. schreibersii*].
——— ——— ——— *Ibid.* 1854, xxxii, ii, 15 [= *Boliv. dilatata*].
——— ——— ——— Hopkins, Execut. Doc., 45 Congress, Sess. 3, IV, Rpt. Chief Engineers, (2), App. W, 1878–79, 885, i, 60.
——— **amphirhoæ**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 20.
——— ——— ——— Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 6.
——— **angulatum**, Ehr. Mikrogeologie, 1854, xxiii, 11 and 12.
——— ——— ——— *Ibid.* 1854, xxvii, 10 [= *Boliv. punctata*].

GRAMMOSTOMUM angulatum, Ehr. Mikrogeologie, 1854, xxxi, 16 [= *Text. agglutinans*].

——— ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 161 [Glauc.], ii, iii [= *Text. sagittula*].

——— **angustipes**, Ehr. Monatsbericht k. preuss. Ak Wiss. Berlin, 1872, 282.

——— **angustum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 368.

——— **apiculatum**, Ehr. Mikrogeologie, 1854, xxvi, 13 [= *Vulvul. pennatula* (Batsch.)].

——— **arenicola**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 21.

——— **areolatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 166.

——— **aristotelis**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 20.

——— **armatum**, Ehr. (cfr.) *Guttulina armata*.

——— **astigma**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 20.

? ——— **attenuatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 368.

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 22 [= *Boliv. dilatata*].

——— ———? ——— Ehr., *Ibid.* 1854, xxiii, 20, 22 and 23 (the same as *Text. aciculata*, 1838").

——— ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 161 [Glauc.], II, II [= *Text. sagittula*].

?——— (**Strophoconus?**) **bulligerum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 283.

——— **bursigerum**, Ehr. Mikrogeologie, 1854, XXXVII, xi, A–D, 9 [=? *Textularia*].

——— **caloglossa**, Ehr. *Ibid.* 1854, xxv, i, A, 17 and 18 [= *Boliv. punctata*].

——— **capreolus**, Parker & Jones. Annals Mag. N. H., [3], XI, 1863, 93.

——— **carinatum**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1847, 446, ii, 81 [=*Boliv. costata* (?) d'O].

——— **caudatum**, Ehr. Monatsber. k. pr. Ak. Wiss. Berlin, 1861, 304.

——— **cerberi**, Ehr. *Ibid.* 1858, 21.

?——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 2.

——— **confluens**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 369.

——— **conjunctum**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 19, iii, 10 [= *Bolivina*].

——— **connivens**, Ehr. Mikrogeologie, 1854. xxiv, 22 and 23 [= *Boliv. dilatata*].

——— **convergens**, Ehr. *Ibid.* 1854, xxv, ii, B, 4 [= *Text. agglutinans*].

——— ——— ——— Ehr., *Ibid.* 1854, xxix, 25, 26 [25? and 26 = *Boliv. punctata*].

——— **cordatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 368.

——— **coronatum**, Ehr. *Ibid.* 1845, 369.

——— **coscinopleurum**, Ehr. *Ibid* 1843, 166.

——— **costulatum**, Ehr. Mikrogeologie, 1854, xxv, i, A, 21 [near *Boliv. costata*].

——— **cribrosum**, Ehr. *Ibid.* 1854, xxiv, 19 [= *Boliv. punctata*]

——— **cribrum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 67 and 93; and Mikrogeologie, 1854, xxi, 82 [= *Boliv. dilatata*].

?——— **decurrens**, Ehr. Mikrogeologie, 1854, xxx, 17 [= *Virg. squamosa;* v. also *Bolivina*].

——— **dendiculatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 271.

——— **depressum**, Ehr. *Ibid.* 1844, 93; and Mikrogeologie, 1854, xix, 82 [= *Text. gibbosa*].

——— ——— ——— Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 21.

——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin. 1872 (1873), xi, 3.

——— (**Vulvulina**) **dilatatum**. Reuss, Zeitschr. deutsch. geol. Ges. III, 1851, 162, viii, 8.

——— **dilatatum**, Ehr. Mikrogeologie, 1854, xxix, 23 [=*Bolivina*].

——— **divergens**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 67, 93 and 206 [v. *Guttulina*].

——— ——— ——— Ehr., Mikrogeologie, 1854, xxi, 86 [= *Boliv. dilatata*].

——— **elegans**, d'Orbigny. Reuss in Geinitz, Grundr. Verstein. 1845-46, 679, xxiv, 77 [*Vulvulina*, 1826].

——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853-56, 236, xxxv², 34*a*, *b*.

——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 170, xi, 123.

GRAMMOSTOMUM elegans, Ehrenberg. Mikrogeologie, 1854, xx, ii, 7 [= *Boliv. punctata*].
?——— **euryleptum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 304.
?——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 8.
——— **eurytheca**, Ehr. Mikrogeologie, 1854, xxv, i, A, 24 [= *T. sagittula*].
——— **falx**, Ehr. *Ibid.* 1854, xxiii, 13.
——— ——— ——— Harting, Verh. Kon. Ak. Wetensch. x, 1864, 10, i, 11.
——— **fasciatum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 283.
——— **gracile**, Ehr. Abhandl. k. preuss. Ak. Wiss. Berlin, 1841, 426.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 25 [= *Virg. squamosa*].
——— ——— ——— *Ibid.* 1854, xxx, 9 [= *Virg. schreibersii*].
——— (Vulvul.) **gramen**, d'Orbigny. Zittel, Handbuch Palæont. (1), 1876, 90, f. 27³ [*Vulvulina*, 1839].
——— **hedyglossa**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 305.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 3.
——— **incrassatum**, Ehr. Mikrogeologie, 1854, xxxi, 21 [= *Virg. schreibersii*].
——— **increscens**, Ehr. *Ibid.* 1854, xxiii, 15.
——— **invalidum**, Ehr. *Ibid.* 1854, xxxii, ii, 17 [=*T. agglutinans* (near)].
——— **læve**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 369.
——— **laterale**, Ehr. *Ibid.* 1844, 92; and Mikrogeologie, 1854, xix, 83 [=*Boliv. punctata*].
——— **laxum?**, Ehr. Mikrogeologie, 1854, xxv, i, A, 15 [=?*Virg. hemprichii*].
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——— ——— ——— Mikrogeologie, 1854, xxiv, 24 and 25 [= *Virg. squamosa*].
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——— **littorale**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 21.
——— **macilentum**, Ehr. Mikrogeologie, 1854, xxvii, 16 [= *Virg. tegulata*, Reuss].
——— **maculatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 166.
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——— **micromega**, Ehr. Mikrogeologie, 1854, xxv, i, A, 22 [= *T. sagittula*, fragment].
——— **millepora**, Ehr. *Ibid.* 1854, xxx, 11 [= *Boliv. dilatata*].
——— (Polymorph.?) **myoglossum**, Ehr. *Ibid.* 1854, xxvii, 18 [= *Virg. squamosa*, fragment].
——— **nanum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 283.
——— **pachyderma**, Ehr. Mikrogeologie, 1854, xxvii, 9 *a*, *b* ("*Text. aciculata* 1838 = several thin species of *Grammostomum*") [= *Boliv. punctata*].
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——— ——— ——— *Ibid.* 1854, xxvi, 14 and 15 [= *Boliv. punctata*].
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——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 4.
——— **pinna**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 304.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 12.
——— **pinnula**, Ehr. Mikrogeologie, 1854, xxix, 24 [= *T. gibbosa*].
——— ——— ——— *Ibid.* 1854, xxx, 14 [= *Boliv. dilatata*].

GRAMMOSTOMUM platystigma, Ehr. Mikrogeologie, 1854, xxvii, 13 [*Boliv. dilatata*].
——— **platytheca**, Ehr. *Ibid.* 1854, xxviii, 33 [= *Text. gibbosa*].
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——— **plicatum**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 426.
——— **polyporum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 369.
——— **polystigma**, Ehr. *Ibid.* 1844, 92; and Mikrogeologie, 1854, xix, 84 [= *Boliv. punctata*].
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——— (prox.) ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1854, 247.
——— ———? ——— Mikrogeologie, 1854, xxv, i, A, 16, 19 and 20 [= *Boliv. punctata*].
——— **polytrema**, Ehr. *Ibid.* 1854, xxviii, 15 and 16 [= *Virg. schreibersii*, Czj.].
——— **ponti**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 22.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 5.
——— **porosum**, Ehr. *Ibid.* 1841, 426.
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——— **pupilla orci**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 247.
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——— ——— ——— Ehr. *Ibid.* 1854, xxix, 28 [= *Virg. squamosa*].
——— ——— ——— Ehr. *Ibid.* 1854, XXXII, ii, 19 [= *Boliv. dilatata*].
——— **rossicum**, Ehr. *Ibid.* 1854, xxxi, 18 and 19 [= *Text. sagittula*].
——— **rotundatum**, Ehr. Bericht k. preuss. Ak. Wiss. erlin, 1845, 370.
——— **scabrum**, Ehr. Mikrogeologie, 1854, xxviii, 14 [= *Text. agglutinans*].
——— **secundarium?**, Ehr. *Ibid.* 1854, xxxi, 20 [= *Text. agglutinans*].
——— **semiporosum**, Ehr. Bericht k. preuss. Ak. Wiss Berlin, 1845, 370.
——— **seriatum**, Ehr. *Ibid.* 1845, 370.
——— **siculum?**, Ehr. Mikrogeologie, 1854, xxiii, 14.
——— ——— ——— *Ibid.* 1854, xxvi, 16 ("*Text. aciculata*, 1838, in part") [= *Boliv. punctata*].
——— **simplex**, Ehr. *Ibid.* 1854, XXXIII, xiii, 27 [= *Boliv. dilatata?*].
——— **spatiosum**, Ehr. *Ibid.* 1854, xxv. i, A, 14 [=*Boliv. punctata*].
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——— **strophoconus**, Ehr. *Ibid.* 1843, 272.
——— **stygium**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 283.
——— **subacutum**, Ehr. Mikrogeologie, 1854, xxv, i, A, 12 [near *Text. agglutinans*].
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——— **sulcatum**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 370.
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——— **tessera**, Ehr. Mikrogeologie, 1854. XXXII. ii, 18 [= *Virg hemprichii*].
——— **thebaicum?**, Ehr. *Ibid.* 1854, xxiii, 19 [v. *Bolivina*] [= *? Virg. hemprichii*].
——— ——— ——— *Ibid.* 1854, xxiv, 20 and 21 =[*Boliv. dilatata*].
——— ——— ——— *Ibid.* 1854, xxvii, 12 [= between *Text. agglutinans* and *Text. sagittula.*]
——— ——— ——— *Ibid.* 1854, xxxi, 25 [= *Virg. schreibersii*].
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——— ——— Ehr. Abh. k. Ak. Wiss. Berlin. 1872 (1873), xi, 4.
——— **tumens**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
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——— **umbra**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 283 and 284.
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GYROIDINA orbicularis, d'Orbigny. P., J. & B. [d'O., Modèles, 13], Ann. Mag. Nat. Hist. [3], XVI, 1865, 20, iii, 85 [= *Rotalia*].

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[GIROIDINA] punctata, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.

——— **soldanii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 278, No. 5 [= *Rotalia*].

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GYROPORELLA, Gümbel, 1871. Abh. k. bay. Ak. Wiss. XI, 1871 (1874), 231 [a genus of calcareous algæ, v. Munier-Chalmas, Comptes Rendus, LXXXV, 1877, 815; and Solms-Laubach, Einleit. Palæophytologie, 1887, 38, etc.].

The species described by Gümbel (to whom refer for synonymy) are: *æqualis*, G.; *annulata* (Schafh.); *curvata*, G.; *cylindrica*, G.; *debilis*, G.; *dissita*, G.; *infundibuliformis*, G.; *macrostoma*, G.; *minutula*, G. [*minuta*]; *multiserialis*, G.; *pauciperforata*, G.; *silesiaca*, G.; *triasina* (Schaur.); *vesiculifera*, G.

See also Karrer, Abh. k. k. Geol. Reichs. IX, 1877, 377, xvi*b*; Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl. 120; Alth, Rozprawy i sprawozd. mat. Przy. Ak. Umiej. [Krakowie], V, 1878, 71, pls. vi and vii; and Pamietnik Akad. Umiej. Krakowie, VI, 1881, 135–137, and Mojs. u. Neumay. Beitr. I, 1882, 317–320 [In the "Beiträge" the genus is altered to *Actinoporella*]; and Stache, Abh. k. k. geol. Reichs. XIII, 1889, 89.

HAECKELINA, Bessels, 1875. Jenaische Zeitschrift für naturwiss. IX, 1875, 265 [= *Astrorhiza*].

——— **gigantea**, Bessels. *Ibid.* IX, 1875, 265, xiv, 1–9.

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HAMMONIA, Soldani. Testaceographia. 1789, I, (1), 56, pl. 36, x [*Rotalia boueana*, d'O., For. Foss. Vienne, 1846, 152, pl. 7, 25–27].

——— Sold. Testac. I, (1), 1789, 60, pl. 47, *II* [*Soldania orbicularis*, d'O., Ann. Sci. Nat. VII, 1826, 281, 5].

HAPLOPHRAGMIUM calcareum [(Will.)]. Terquem, Bull. Soc. Zool. Fr. XI, 1886, 332, xi, 11*a*, *b* [refers to *Proteonina pseudospirale*].
—— (Lit.) **canariensis**, d'O. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 192, v, 17 [*Nonionina*, 1839].
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—— **cassis** (Parker). Brady, Report Challenger, 1884, 304, xxxiii, 17–19 [*Lituola*, 1870].
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—— **depressum**, Jones. v. *Lituola nautiloidea.*
—— **discus**, Rzehak. Verh. nat. Ver. Brünn, XXIV, 1885 (1886), 78, i, 1.
—— **dubium**, Terquem. Mém. Soc. Géol. France, [3], IV, 1886, 41, iv, 29 and 30.
—— **emaciatum**, Brady. Report Challenger, 1884, 305, xxxiii, 26–28.
—— **fœdissima**, Reuss. Hoernes, Elem. Palæont. 1884, 32, f. 25; French ed. 1886, same fig. [*Dentalina*, 1860].
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—— —— —— Brady, Report Challenger, 1884, 304, xxxiii, 20–25.
—— —— —— De Folin, Le Naturaliste, Ann. 10, 1888, 157, f. 1, 2 and 3.
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—— —— —— var. Haeusler, Neues Jahrbuch, Beil. IV, (1), 1885, 13, i, 21; ii, 1 and 2.
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—— —— —— Brady, Report Challenger, 1884, 312, xxxv, 10 and 11.
—— **glomeratum** (Brady). Wright, Proc. Belf. Field Club, 1880–81 (App.), 180, viii, 1, 1*a* [*Lituola*, 1878].
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—— —— —— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 9, ii, 3 and 4; and Mitth. a d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 11, same pl. and fig. [*H. humboldi* in text].
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—— —— —— v. **latum**. *Ibid.* II, (3), 1884, 198, vii, 1.
—— —— —— Steinmann, Elem. Paleont. I, 1888, 21 and 26, f, 3*D*, 7*D*.
—— **incisum**, Stache. Novara-Exped., Geol (1), 1864, 165, xxi, i.
—— **inflatum**, Karrer. Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 449, ii, 7 [error for 6].
—— **inflatum**. Reuss. Reuss' Model, No. 3, 1865 (Catal. No. 3, 1861) [= *H. nautiloidea*, Lam.].

HAPLOPHRAGMIUM scitulum, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 50.
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——— ——— ——— Haeusler, Neues Jahrbuch, Beil. IV, (1), 1885, 13, ii, 9.
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——— **tuberosum**, Terquem. Mém. Soc. Géol. France, [3], IV, 1886, 41, iv, 26–28.
——— **turbinatum**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 50.
——— ——— ——— Brady, Report Challenger, 1884, 312, xxxv, 9*a*, *c*.
——— **verruculosum**, Gümbel. Sitz. k.-bayer. Ak. Wiss. München, I, 1871, 63, i, 1*a*, *b*.
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——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, (16), ii, 1–1*e*.
?——— Wisnioski, Jahrb. k. k. geol. Reichs. XXXVIII, (1889), 695, xiii, 67.

HAPLOPORELLA, Gümbel, 1871. Abh. k. bay. Ak. Wiss. XI, 1871 (74), 256. [A genus of Calcareous algæ. See Solms-Laubach, Einleit. Palæophytologie, 1887, 38]. The spp. described by Gümbel (to whom refer for synonymy) are: *annulus* (Park. & Jones) [*Dactylopora*, 1860]; *biscutata*, G.; *digitata* (Park. & Jones) [*Dactylopora*, 1860]; *eruca* (Park. & Jones) [*Dactylopora*, 1860]; *fasciculata*, G.; *glandulosa*, (d'Arch) [*Prattia*, 1850]; *marginoporella* (Mich.); *reticulata*, (Defr.); *scrobiculata*, G.; *vesiculosa*, G.

HAPLOSTICHE, Reuss, 1861. Sitz. k. böhm. Ges. Wiss., Jahrg. 1861, (1), 16; Brady, Report Challenger, 1884, 317.
——— **clavulina**, Reuss. In Geinitz, Palæontographica, XX, (2), 1874, 121, xxiv, 7 and 8.
——— **compressa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 309, xvii, 17, 17*a*.
——— **constricta**, Reuss. In Geinitz, Palæontographica, XX, (2), 1874, 122, xxiv, 9–12 [*Nodosaria*, 1845].
——— **dentalinoides**, Reuss. *Ibid.* XX, (2), 1874, 121, xxiv, 4–6.
——— **depressa**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 130, ii, 6.
——— **fœdissima**, Reuss. Reuss' Model, No. 1, 1865 (Catal. No. 2, 1861) [*Dentalina*, 1860].
——— ——— ——— Reuss in Geinitz, Palæontographica, XX, (2), 1874, 121, xxiv, 1–3.
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——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, v, (1885), 1050, lxxxvi, 11.
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——— ——— ——— Zittel, Handbuch Palæont. I, 1876, 76, f. 8^2.
——— ——— ——— Haeusler, Neues Jahrbuch, Beil. IV, (1), 1885, 15, i, 26.
——— **scarenæensis**, Hantken, Ertek. termesz. köreböl, XIII, No. 1, 1883, 22, ii, 5; and Math. Nat. Ber. Ungarn, II, 1884, 143.
——— **soldanii** (Jones & Park.). Brady, Report Challenger, 1884, 318, xxxii, 12–18 [*Lituola*, 1860].

HASTIGERINA, Wyville Thomson, 1876. Proc. Roy. Soc. XXIV, 1876, 534; Brady, Report Challenger, 1884, 612.

HASTIGERINA murrayi, Wy. T. Murray, Proc. Royal Soc. xxiv, 1876, 534, 22 and 23. [v. *Globigerina*].
——— ——— ——— Hertwig, Jenaische Zeitschr. für. Naturwiss. xi, 1877, 343, xx, 7 [structural].
——— ——— ——— Haeckel, Protistenreich, 1878, 38, f. 24. [This is Murray's fig. of *Globig. bulloides* showing spinous processes.]
——— **pelagica** (d'Orb.). Brady, Report Challenger, 1884, 613, lxxxiii, 1-8 [*Nonionina*, 1839].
HAUERINA, d'Orbigny, 1839. De la Sagra, Hist. Phys. Ile Cuba, 1839, "Foraminifères," pp. xxxviii, xxxix; Brady, Report Challenger, 1884, 190.
——— **alternans**, Costa. Atti Accad. Pontaniana, vii, (2), 1856, 211, xx, 5, *A*, *B*, *C*.
——— **antiqua**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, (1), 1862 (1863), 35, ii, 1*a*, *b*.
——— **borealis**, Brady. Quart. Journ. Micr. Sci. xxi, 1881, 46 [referred to *Planispirina contraria*, 1884].
——— **circinata**, Brady. *Ibid.* xxi, 1881, 47.
——— ——— ——— Brady, Report Challenger, 1884, 191, xi, 14-16.
——— **compressa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 119, v, 25-27.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, iii, 1853-56, 208, xxxv², 10*a*, *b*, *c*.
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——— ——— ——— Reuss' Model. No. 13, 1865 (Catal. No. 27, 1861).
——— ——— ——— Jones in Microgr. Dict. ed. 4, 1883, 383. xxiii, 8*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 190, xi, 12 and 13.
——— **cristata**, Fischer. Fonds de la mer, i, chap. xvii (1870), 252, no fig. [misspelt *Hanerina*].
——— **exigua**, Brady. Q. Journ. Micr. Sci. xix, 1879, 267, no figs. [referred to *Planispirina*, 1884].
——— **inconstans**, Brady. *Ibid.* xix, 1879, 268, no figs. [v. *Ophthalmidium*].
——— **intermedia**, Howchin. Trans. R. Soc. S. Australia, xii, 1889, 4, i, 6.
——— **ornatissima** (Karr.). Brady, Report Challenger, 1884, 192, vii, 15-22 [v. *Quinqueloculina*, 1868].
——— **plicata**, Parker & Jones. Carpenter, Parker & Jones, Introd. Foram. 1862, vi, 35.
——— sp. Schwager, Boll. R. Com. Geol. Ital. viii, 1877, 27, pl., 105.
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——— d'Orb. Butschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 190, iv, 20.
HELENIS spatosus, Montfort. Conch. syst. i, 1808, 195, 49th genre [= *Orbiculina adunca*].
HELICITE, Guettard. Mém. diff. parties Science, etc. ii, 1770, 185; iii, 1770, 431, xiii [= *Nummulites*].
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HELICITEN, Walch. Das steinreich systematisch entworfen, ed. 2, i, 1769, 136, viii, 3 [*Nummulites* and *Alveolina*].
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HELICITES, Gesner, Tract. phys petrif. 1758, 50 [= *Nummulites*].
——— **perforatus**, Blainville. Man Malac. 1825, 373 [v. *Nummulina* and *Nummulites*].
——— **radiatus**, Blainville. *Ibid.* 1825, 373 [v. *Nummulina* and *Nummulites*].
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HELICOZA, Möbius, 1880. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 103 [= *Polystomella*].
——— **craticulata** (F. & M.). Möbius, *ibid.* 1880, 103, xii, 2 [*Nautilus*, 1798] [structural].
HELICOSORINA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1 [a family group name].
HELICOTROCHINA, Ehrenberg, 1838. *Ibid.* 1838 (1840), Tab. 1 [a family group name].

HELMINTHOLITHUS, von Born. Index fossilium, Pragæ, 1775, 28 [= *Cyclolites hemisphærica*, an anthozoan].
HEMICRISTELLARIA, Stache, 1864. Novara-Exped., Geol. (1), 1864, 222.
——— **corculum**, Stache. *Ibid.* (1), 1864, 223, xxiii, 2*a*, *b*.
——— **excavata**, Stache. *Ibid.* (1), 1864, 224, xxiii, 3*a*, *b*.
——— **infrapapillata**, Stache. *Ibid.* (1), 1864, 224, xxiii, 4*a*, *b*.
——— **procera**, Stache. *Ibid.* (1), 1864, 222, xxiii, 1*a*, *b*.
——— **verrucosa**, Stache. *Ibid.* (1), 1864, 226, xxiii, 5*a*, *b*.
HEMICRYPTA, Folin, 1882. Congrès Scient. Dax, 1882 (1883), 327.
HEMIFUSULINA, v. Möller. Neues Jahrbuch, 1877, 144.
——— **bocki**, v. Möller. Mém. Ac. Imp. Sci. St. Petersburg, [7], xxv, No. 9, 1878, 76, v, 2*a–e*; xi, 1–3.
HEMIROBULINA, Stache. Novara-Exped., Geol. (1), 1864, 227.
——— **arcuatula**, Stache. *Ibid.* (1), 1864, 227, xxiii, 6*a*, *b*.
——— **compressa**, Stache. *Ibid.* (1), 1864, 229, xxiii, 8*a*, *b*.
——— **galeola**, Stache. *Ibid.* (1), 1864, 228, xxiii, 7*a*, *b*.
HEMISTEGINA, Kaufmann. Beitr. geol. Karte Schweiz, (5), 1867, 150.
——— **rotula**, Kaufmann. *Ibid.* (5), 1867, 150, viii, 19 [v. *Pulvinulina* = *Amphistegina*].
HEMISTEREA nautilus, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 284.
HEMISTICTA, Ehr., 1872.
——— **amplificata**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 284.
——— ——— ——— Ehrenberg, Abh. k. preuss. Ak. Wiss. Berlin, 1872 (1873), iii, 12 [= *Pulvinulina*].
HERION rostratus, Montfort. Conch. syst. I, 1808, 231, 58th genre [= *Cristellaria rostrata*].
HETERASTRIDIUM. Reuss, v. **Stoliczkaria**.
HETEROCYSTINA, Smedley, Ency. Metrop. 1845, error for *Heterostegina*.
HETEROHELIX, Ehrenberg, 1843. [Changed by Ehrenberg to *Spiroplecta* in 1844. See Brady, Challenger, 1884, 375.]
HETEROLEPA, Franzenau, 1884. Termés. Füzetek, VIII, 1884, 181 and 214 [founded on *Rotalina dutemplei*, d'O.].
——— **bullata**, Franz. *Ibid.* VIII, 1884, 184 and 217, v, 5, 7, 9 and 11.
——— **costata**, Franz. *Ibid.* 183 and 216, v, 2 and 8.
——— **dutemplei**, d'Orb. *Ibid.* IX, 1885, 151, vii, 1–4 [*Rotalina*, 1846].
——— **præcincta**, Franz. *Ibid.* VIII, 1884, 183 and 216, v, 4, 6 and 10.
——— **simplex**, Franz. *Ibid.* 182 and 215, v, 1.
——— ——— ——— Franz. Földt. Közl. XIV, 1884, 298, fig.
HETEROSTEGINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 305; Brady, Report Challenger, 1884, 745.
——— **antillarum**, d'Orbigny. De la Sagra Hist. Phisiq., etc. Cuba, 1839, "Foraminifères," 122, vii, 24 and 25; also in Spanish, 1840, 121, same pl. and fig.
——— ——— ——— Quenstedt, Handb. Petref. ed. 3, (5), (1885), 1058, lxxxvi, 57.
——— **carpatica**, Uhlig. Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 201, ii, 14 and 15; and 202, f. 10.
——— **clathrata**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 165, III, x [= *Amphisteg. javanica*, Ehr.] [Glauc.].
——— **complanata**, Meneghini. Paléont. Ile Sardaigne, 1857, 544, *II*, 6, 6′, 6*a*, 6*b*, 6*b*′.
——— **costata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 212, xii, 15–17.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 205, xxxv², 5*a–c*.
——— ——— ——— Reuss' Model. No. 80, 1865 (Catal. No. 100, 1861).
——— ——— ——— Roemer, Geologie von Oberschlesien, 1870, 394, xli, 12–14.
——— ——— ——— Zittel, Handbuch Palæont. I, 1876, 102, f. 42.
——— ——— ——— Karrer, Abh. k. k. geol. Reichs. IX, 1877, 388, xvi*b*, 60.
——— ——— ——— Hoernes, Elem. Palæont. 1884, 27, f. 17; French ed., 1886, same fig.
——— **curva**, Möbius. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 105, xiii, 1–6 [structural].

HETEROSTOMUM, Ehrenberg, 1854.
——— **alternans**, Ehr. Mikrogeologie, 1854, xxx, 37 [= *Virg. hemprichii*, passing towards *Cassidulina*].
——— **cyclostomum**, Ehr. *Ibid.* 1854, xxviii, 31 [=*Text. gibbosa*].
——— **nucula**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 305.
HIPPOCREPINA, Parker, 1870. In Dawson, Canad. Nat. n. s. v, 1870, 176; Brady, Report Challenger, 1884, 324.
——— **indivisa**, Parker. Dawson, Canad. Nat. n. s. v, 1870, 176, f. 2.
——— ——— ——— Dawson, Amer. Journ. Sci. [3], I, 1871, 206, f. 2; and Annals Mag. N. H. [4], VII, 1871, 86, f. 2.
——— ——— ——— Brady, Ann. Mag. Nat. Hist. [5], VIII, 1881, 407, xxi, 3*a*, *b*, and 4.
——— ——— ——— Brady, Denkschr. k. Ak. Wiss. Wien, XLIII, (2), 1882 [1881], 100, ii, 3*a*, *b*, 4.
——— ——— ——— Brady, Report Challenger, 1884, 325, xxvi, 10–14.
HOLOCOCCUS?, Ehrenberg, 1859. See *Miliola* (*Holococcus?*) *panderi*, Ehr. Monatsber. k. preuss. Ak. Wiss. 1862, 601, pl., 7–11 [= *Lagena?*].
HOLOCLADINA pustulifera, Carter. Ann. Mag. Nat. Hist. [5], v, 1880, 447, xviii, 4*a*–*g*. [One of the Testamæbiformiæ; Brady, Report Challenger, 1884, 77].
HORMOSINA, Brady, 1879. Q. Journ. Micr. Sci. XIX, 1879, 56; Brady, Report Challenger, 1884, 325.
——— **carpenteri**, Brady. Quart. Journ. Micros. Sci. XXI, 1881, 51 [v. "Moniliform *Lituola*," 1875].
——— ——— ——— Carpenter, The Microscope, ed. 6, 1881, 563, f. 321, *f*.
——— ——— ——— Brady, Report Challenger, 1884, 327, xxxix, 14–18.
——— **globulifera**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 60, iv, 4 and 5.
——— ——— ——— Carpenter, The Microscope, ed. 6, 1881, 563, f. 320, c.
——— ——— ——— Brady, Report Challenger, 1884, 326, xxxix, 1–6.
——— ——— ——— De Folin, Le Naturaliste, x, 1888, 87, f. 1 and 2.
——— **monile**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 52.
——— ——— ——— Brady, Report Challenger, 1884, 328, xxxix, 10–13.
——— **normani**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 52.
——— ——— ——— Brady, Report Challenger, 1884, 329, xxxix, 19–23.
——— **ovicula**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 61, iv, 6.
——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 199, v, 15.
——— ——— ——— Brady, Report Challenger, 1884, 327, xxxix, 7–9.
HORTOCERATIA, Soldani. Testaceographica, 1789 II, App. 141, 5, 37 *m*, *M* [*Nodos. affinis*, d'O. For. Foss. Vienne, 1846, 39, i, 36–39].
——— **vaginulam gladii referentia**, Sold. *Ibid.* 1789, II, App. 141, 6, 44*n*, *N* [*Vaginulina striata*, d'O. Ann. Sci. Nat. VII, 1826, 257, 3].
HYALEINA, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xviii, 22–25 [= *Lagena marginata*].
HYBRIDINA, Kübler & Zwingli, 1866. Neujahrsblatt Burgersbibl. Winterthur, 1866, 8.
——— **liasica**, Kübler & Zwingli. *Ibid.* 1866, 8, i, 10 [= *Dentalina*, deformed].
——— **obliqua**, Kübler & Zwingli. *Ibid.* 1866, 9, i, 21 [= *Dentalina*].
HYMENOCYCLUS, Bronn, 1851-2. Lethæa Geognostica, ed. 3, II, 1851–52, 94.
——— **concameratus**, Schafhäutl. Sud-Bayerns Lethæa Geogn. 1863, 108, xiv, 9*a*–*e*.
——— **cymbolum**, Schafhäutl. *Ibid.* 1863, 107, xiv, 7*a*, *b*.
——— **faujasi** (Defr.). Bronn, Lethæa Geognostica, ed. 3, II, 1851-52, 94, xxix[1], 29 [*Lycophrys*, 1824].
? ——— **mantelli** (Morton). *Ibid.* ed. 3, III, 1853–56, 253, xxxv[3], 11 [*Nummulites*, 1833].
——— **papyraceus** (Boub.). *Ibid.* ed. 3, III, 1853–56, 251, xxxv[3], 10*a*–*g* [*Nummulites*, 1832]
——— **patellaris**, Schafhäutl. Sud-Bayerns Lethæa Geog. 1863, 108, xv, 3*a*, *b*, *c* [*Asterodiscus* on plate].
——— **rugosus**, Schafhäutl. *Ibid.* 1863, 107, xiv, 6*a*–*d*.
——— **umbo**, Schafhäutl. *Ibid.* 1863, 106, xiv, 5*a*–*k*, 8*a*–*c* [*Nummulina*, 1846].
HYPERAMMINA, Brady, 1878. Ann. Mag. Nat. Hist. [5], I, 1878, 433; Brady, Report Challenger, 1884, 257.

HYPERAMMINA arborescens (Norm.). Brady, Report Challenger, 1884, 262, xxviii, 12 and 13; and f. 10, p. 263 [*Psammatodendron*, 1881].
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——— **elongata**, Brady. Ann. Mag. Nat. Hist. [5], I, 1878, 433, xx, 2*a*, *b*.
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——— ——— ——— v. **clavatula**, Howchin. Journ. R. Microsc. Soc. 1888, 535, viii. 1, 2.
——— **friabilis**, Brady. Brady, Report Challenger, 1884, 258, xxiii, 1–3, 5, 6.
——— **palmiformis**, Pearcey. Proc. N. H. Soc. Glasgow, n. s. II (1888), 171, iii, 1–4.
——— **ramosa**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 33, iii, 14 and 15.
——— ——— ——— Brady, Report Challenger, 1884, 261, xxiii, 15–19.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 217, xli, 1–4, 13.
——— **subnodosa**, Brady. Report Challenger, 1884, 259, xxiii, 11–14.
——— **vagans**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 33, v, 3.
——— ——— ——— Moseley, Nature (Apr. 15, 1880), XXI, 570, f. 11*c*.
——— ——— ——— Haeusler, Neues Jahrbuch, 1883, I, 58, iii, 7–10.
——— ——— ——— (spiral var.). Haeusler, Quart. Journ. Geol. Soc. XXXIX, 1883, 26, ii, 2–6.
——— ——— ——— Brady, Report Challenger, 1884, 260, xxiv, 1–9.
——— ——— ——— Howchin, Journ. R. Microsc. Soc. 1888, 535, viii, 3.
——— Brady. De Folin, Bull. Soc. Nat. Hist. Toulouse, XV, 1881, 135; 15 new species proposed but not described!
HYPERAMMINELLA, Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 1881, 140, not described; 1 species proposed.
——— de Folin. Le Naturaliste, IX, 1887, 114. f. 9.
IDALINA, Schlumberger & Munier-Chalmas, 1884. Bull. Soc. géol. France, [3], XII, 1884, 629; XIII, 1885, 298, etc.
——— **antiqua** (d'Orb.). Mun.-Ch. & Schlumb., *Ibid.* [3], XIII, 1885, 292, f. 17; 296, etc., f. 22–35; and pl. xiii [structural] [*Biloculina*, 1847].
ILOTES rotalitatus, Montfort. Conch. Syst. I, 1808, 199, 50th genre [= *Orbic. adunca*].
ILYOPEGMA, de Folin. Bull. Soc. N. H. Toulouse, XV, 1881, 139; not described, 1 species proposed.
ILYOPERIDIA, de Folin. *Ibid.* XV, 1881, 139; not described, one species proposed.
ILYOSPHÆRA, de Folin, 1882. Congrès Scient. Dax, 1882 (1883), 328 [not described].
ILYOZOTIKA, de Folin. Bull. Soc. N. H. Toulouse, XV, 1881, 139; not described, 1 species proposed.
INVOLUTINA, Terquem, 1862. Mém. Ac. Imp. Metz, XLII, 1862, 450.
——— **aspera**, Terquem. *Ibid.* XLIV, 1863, 431, x, 21*a*, *b* [= *Ammodiscus incertus*].
——— **carbonica**, Schwager. Pal. Indica, [13], No. 7, 1887, 992, cxxviii, 7–9.
——— **crassa**, Brady. Rept. Brit. Assoc. (Exeter), 1869, 382, not figured [v. *Endothyra*].
——— **cylindrica**, Brady. *Ibid.* 1869, 382, not figured.
——— **cylindroides**, Brady. *Ibid.* 1869, 382, not figured.
——— **deslongchampsi**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 432, x, 12 [22] *a*, *b* [v. *Problematina*].
——— **incerta**, Brady, Rept. Brit. Assoc. (Exeter), 1869, 382, not figured.
——— **jonesi**, Terq. & Piette. Terquem, Mém. Ac. Imp. Metz, XLII, 1862, 461, vi, 22*a*, *b*, *c*.
——— **liassica** (Jones). Brady, Geol. Mag. I, 1864, 193, ix, 1–6 [*Nummulites*, 1853].
——— [**liasina**] ——— Bornemann, Zeitschr. deutsch. geol. Ges. XXVI, 1874, 713, xviii, 1–3; xix, 1–7.

INVOLUTINA liassica, (Jones). Tate & Blake, Yorkshire Lias, 1876, 453, xviii, 6, 6*a*.

——— **[liasina,** (Jones)]. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 54.

——— **[liasina** (Jones)]. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 209, ix, 12.

——— **limitata,** Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 433, x, 24*a*, *b* [v. *Silicina*].

——— **lobata,** Brady. Rept. Brit. Assoc. (Exeter), 1869, 382, not figured [referred to *Endothyra Bowmani*, 1876].

——— **macella,** Brady. *Ibid.* 1869, 382, not figured [v. *Endothyra*].

——— **nodosa,** Terquem. Sixième Mém. Foram. Lias, 1866, 523, xxii, 25*a*, *b* [v. *Problematina*].

——— **obliqua,** Brady. Rept. Brit. Assoc. (Exeter), 1869, 382, not figured [v. *Endothyra*].

——— **petrea,** Terquem. Cinquième Mém. Foram. Lias, 1866, 446, xviii, 17*a*, *b*, *c* [v. *Problematina*].

——— **polymorpha,** Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 432, x, 23*a*, *b*, *c* [v. *Silicina*].

——— **radiata,** Brady. Rept. Brit. Assoc. (Exeter), 1869, 382, not figured [v. *Endothyra*].

——— **recta,** Brady. *Ibid.* 1869, 382, not figured.

——— **silicea,** Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 450, vi, 11*a*, *b* [= *Ammodiscus incertus*].

——— **subrotundata,** Brady. Rept. Brit. Assoc. [Exeter], 1869, 382, not figured.

ITEITÆ, Scheuchzer. Misc. cur. Ephem. Acad. Cæs. Leop., Dec. III, Append. Anno V and VI (1700), 63, f. *j* [= *Nummulites*].

JACULELLA, Brady, 1879. Q. Journ. Micr. Sci. XIX, 1879, 35; Brady, Report Challenger, 1884, 255.

——— **acuta,** Brady. Q. Journ. Micr. Sci. XIX, 1879, 35, iii, 12 and 13.

——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 143, xii, 432.

——— ——— ——— Brady, Report Challenger, 1884, 255, xxii, 14–18.

——— **obtusa,** Brady. Proc. Roy. Soc. Edinburgh, XI, 1882, 714, not figured.

——— ——— ——— Brady, Report Challenger, 1884, 256, xxii, 19–22.

——— De Folin, Bull. Soc. N. H. Toulouse, 1881, XV, 133; 10 new species proposed but not described!

JESITES vermicularis, Montfort. Conch. Syst. I, 1808, 103, 26th genre [= ? *Serpula*; ? *Pulvinulina*; ? *Spirillina*].

JULIA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 1881, 141, not described, 6 species proposed!

KALAMOPSIS, Folin, 1882. Congrès Scient Dax, 1882 (1883), 320 [? foraminiferal]. Involucrum irregulariter subcylindricum, tubularium, elongatum, ad unam extremitatem closum, ad alteram forsam apertum, subvitreum, interdum inflatum sicut geniculatum.

——— **vaillanti,** Folin. *Ibid.* 1882 (1883), 320.

——— ——— ——— De Folin, Actes Soc. Linn. Bordeaux, XL, (5), 1887, 288, viii, 12*a*–*c*.

KERAMOSPHÆRA, Brady, 1882. Ann. Mag. Nat. Hist. [5], x, 1882, 245; Brady, Report Challenger, 1884, 225.

——— **murrayi,** Brady. Ann. Mag. Nat. Hist. [5], x, 1882, 245, xiii, 1–4.

——— ——— ——— Brady, Report Challenger, 1884, 224, f. 8, 225.

KIKRAMMINA, de Folin. Bull. Soc. N. H. Toulouse, XV, 1881, 132, not described, 1 species proposed.

KÜMMELSTEIN,
KÜMMISCHSTEIN,
KÜMMSTEIN,
} Kircher, Mund. subterr. 1665–78, 29 [= *Nummulites*].

L. urceolata (fragmentum) articulis singulis urceolatis tubo conjunctis, Jura. Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1838, 132 [no genus is given].

LAGENA apiculata, Reuss. Terrigi, Mem. R. Acc. Lincei, (4), VI, 1889, 111, v, 11.
——— ——— ——— Mariani, Boll. Soc. Geol. Ital. VII (1889), 285, x, 5.
——— ——— ——— see *L. sulcata*, W. & J. and *L. vulgaris*.
——— **aspera**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, (1), 1861 (1862), 305, i, 5 [v. *Entosolenia*].
——— ——— ——— Reuss, *ibid.* XLVI, (1), 1862 (1863), 335, vi, 81.
——— ——— ——— Terq. & Berthelin, Mém. Soc. Géol. France, [2], x, 1875, 15, i (xi), 10.
——— ——— ——— Brady, Report Challenger, 1884, 457, lvii, 7–10, var., 6, 11, 12.
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 78, ii, 1.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 337, xiv, 10–12.
——— ——— ——— Haeusler, Neues Jahrb. 1887, I, 185, v, 14–18.
——— **auriculata**. Brady. Quart. Journ. Micros. Sci. XXI, 1881, 61.
——— ——— ——— Brady, Report Challenger, 1884, 487, lx, 29, 33.
——— ——— ——— var. **costata**, Brady. Quart. Journ. Micros. Sci. XXI, 1881, 61.
——— ——— ——— ——— ——— Brady, Report Challenger, 1884, 487, lx, 38.
——— ——— ——— v. **substriata**. Brady. Quart. Journ. Micros. Sci. XXI, 1881, 61 [referred in 1884 to *L. alveolata*, q. v.].
——— **badensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 38, iv, Badener Schicht 1 [= *L. lævis*].
——— **bicarinata** (Terquem). Balkwill & Millett, Journ. Micr. III, 1884, 82, ii, 4 [*Fissurina*, 1882].
——— ——— (trigonal form) ——— Balkwill & Millett, *ibid.* III, 1884, 82, iii, 9.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 342, xii, 30.
——— ——— ——— Wright, Proc. Belfast Nat. Field Club, 1884–5, App. IX, 1886, 320, xxvi, 8*a*, *b*.
——— **bifrons**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 607, i, 9*a*, *b*.
——— **bittneri**, Karrer. Abh. k. k. Geol. Reichs. IX, 1877, 378, xvi*b*, 18.
——— **botelliformis**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 60.
——— ——— ——— Brady, Report Challenger, 1884, 454, lvi, 6.
——— **bradyana**, Fornasini. Boll. Soc. Geol. Ital. VII, 1888, 47, iii, 8.
——— **bullæformis**, Schwager. Benecke's Geogn.-Pal. Beiträge, I, 1868, 655, xxxiv, 5.
——— ——— ——— Deecke, Abh. geol. Specialkarte Elsass.-Lothr. IV, (1), 1884, 23, i, 9, 9*a*.
——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [18], i, 1–1*b*.
——— **cæpulla**, Schwager. Novara-Exped., Geol. II, 1866, 205, iv, 20*a*, *b*.
——— **capillosa** (Schwager), v. *Fissurina*.
——— **castrensis**, Schwager. Novara-Exped., Geol. II, 1866, 208, v, 22.
——— ——— ——— Brady, Report Challenger, 1884, 485, lx, 1, 2 and 3 ?.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 341, xii, 20 and 21.
——— **catenulata** (Will.) Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 332, vi, 75 and 76 [v. *Entosolenia squamosa*].
——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 11.
——— ——— [Reuss]. Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 7, i, 10.
——— **caudata**, d'Orbigny. Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 325, iii, 29 [*Oolina*, 1839].
(——— ——— ———). Parker & Jones, Phil. Trans. 1865, 352, xvi, 7.
——— ——— ——— Mackie, Science Gossip, 1867, 129, f. 106.
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 78, i, 9.
——— ——— ——— see *L. sulcata*, W. & J. and *L. vulgaris*.
——— **clathrata**, Brady. Report Challenger, 1884, 485, lx, 4.
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 82, ii, 14; and iv, 5 (near *castrensis*).

LAGENA elongata, Ehr. Brady, Report Challenger, 1884, 457, lvi, 29 [see *Miliola*].
——— **emaciata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 319, i, 9.
——— **exsculpta**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 61.
——— ——— Brady, Report Challenger, 1884, 467, lviii, 1; lxi, 5.
——— **faba**, Balkwill & Millett. Journ. Micr. III, 1884, 81, ii, 10.
——— ——— (trigonal form) ——— *Ibid.* III, 1884, iii, 7.
——— **fasciata**, Egger. Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 323, ii, 24*a*, *b* [*Oolina*, 1857].
——— **favosa**, Reuss. *Ibid.* XLVI, (1), 1862 (1863), 334, v, 72, 73.
——— **favosa-punctata**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 62.
——— ——— ——— Brady, Report Challenger, 1884, 473, lviii, 35; lix, 4; lxi, 2.
——— ——— ——— Woodward & Thomas, 13 Ann. Rep. Geol. N. H. Survey Minnesota, for 1884 (1885), 170, iv, 32, 33, 34 and 38.
——— **feildeniana**, Brady. Ann. Mag. Nat. Hist. [5], I, 1878, 434, xx, 4.
——— ——— ——— Brady, Report Challenger, 1884, 469, lviii, 38 and 39.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 339, xiv, 19.
——— **filicosta**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 328, iv, 50, 51 [v. *Lagenulina*].
——— ——— ——— Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 143, i, 12.
——— **fimbriata**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 61.
——— ——— ——— Brady, Report Challenger, 1884, 486, lx, 26–28.
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 83, ii, 5.
——— (**fissurina**), Reuss, see *L. vulgaris* [*Fissurina* refers to the genus *not* species].
——— **florida**, Terquem. Mém. Soc. Géol. France, [3], II, 1882, 26, i (ix), 9.
——— **formosa**, Schwager. Novara-Exped., Geol. II, 1866, 206, iv, 19*a*, *b*, *c*, *d*; vii, f. 1.
——— ——— ——— Brady, Report Challenger, 1884, 480, lx, 10, 18–20; and 8 ?, 17 ?.
——— ——— ——— v. **brevis**, Brady. *Ibid.* 1884, 480, cxiv, 10*a*, *b*.
——— ——— ——— v. **comata**, Brady. *Ibid.* 1884, 480, lx, 22.
——— ——— ——— v. **favosa**, Brady. *Ibid.* 1884, 480, lx, 21.
——— ——— **foveolata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 332, v, 65.
——— **franconica**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 214, iii, 1*a*, *b*.
——— ——— ——— Schwager, *ibid.* XXI, 1865, 95, vii, 22.
——— **geometrica**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 334, v, 74.
——— ——— ——— Hantken, A magy. kir. földt. int évkönyve, IV, 1875 (1876), 18, xii, 8; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 22, same pl. and fig.
——— **globosa** (Montagu). Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 144, lvi, 37 and 40 [*Vermiculum*, 1803, v. also *Lagenulina*].
——— ——— ——— Williamson, Mem. Lit. Phil. Soc. Manchester, [2], VIII, 1848, 47, pl., 39.
——— ——— [(Walk.)] Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 318, i, 1–3.
——— ——— [(Walker)]. Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 143, i, 13–14.
——— ——— [Walk.] var. **globosa asperella**, Karrer. Sitz. k. Ak. Wiss. Wien, LII, (1), 1865 (1866), 496, pl., 11.
——— ——— ——— J., P. & B. Crag. Foram. Pal. Soc. XIX, 1866, 32, i, 32.
——— ——— ——— Mackie, Science Gossip, 1867, 129, f. 105.
——— ——— [Walker]. Terquem, Mém. Ac. Imp. Metz, LI, 1870, 351, XXV, 25–27 [error for 24–26].
——— ——— ——— v. **emaciata**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, (1), 1870, 466; v. Schlicht, Foram. Septar. Pietzpuhl, 1870, i, 10.
——— ——— ——— v. **ovalis**, Reuss. *Ibid.* LXII, (1), 1870, 466; *ibid.* 1870, i, 6, 7, 9.

LAGENA hispida, Reuss. Wright, Proc. Belf. Field Club, (App.), 1876–7, 104, iv, 7.
—— —— —— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 28, i (ix), 13.
—— —— —— Brady, Report Challenger, 1884, 459, lvii, 1–4; lix, 2–5.
—— —— —— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 7, i, 8 and 9.
—— —— —— Haeusler, Neues Jahrb. 1887, I, 185, v, 7–13.
—— —— —— see *L. vulgaris*.
—— **howchiniana**, Brady. Carbonif. Foram. Pal. Soc. XXX, 1876, 121, x, 1–5 [v. *Archælagena*].
—— **[howchiana]** —— Prestwich, Geology, 1888. ii, 101, f. 47*b*.
—— **hystrix**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 335, vi, 80.
—— **[histrix]** —— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 28, i (ix), 14.
—— —— —— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 12.
—— **[histrix]** —— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 7, i, 7.
—— **incurvata**, Green. Amer. Journ. Microsc. VI, 1881, 46, pl., 3.
—— **inornata** (d'Orbigny). Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 320, i, 12 [*Oolina*, 1839].
—— **interrupata** (Will.). Terq., Mém. Soc. Géol. France, [3], II, 1882, 27, i (ix), 10 [v. *L. striata*, *L. sulcata*, *L. vulgaris*].
—— **isabella** (d'Orb.). Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 330, iv, 55 and 56 [*Oolina*, 1839].
—— **jeffreysii**, Brady. Rept. Brit. Assoc. (Nottingham), 1866, 70, not figured.
—— —— —— Wright, Proc. Belf. Field Club, 1876–7, (App.), 104, iv, 15.
—— **lævigata** (Reuss). Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 177, i, 6 [*Fissurina*, 1850].
—— —— —— Brady, Report Challenger, 1884, 473, cxiv, 8*a*, *b*.
—— —— —— Balkwill & Millett, Journ. Micr. III, 1884, 81, ii, 6.
—— —— —— (trigonal form). *Ibid.* III, 1884, 81, iii, 6.
—— —— —— var. **quadrata**, Will. Wright, Proc. Belfast Nat. Field Club, 1884–5, App. IX, 1886, 324, xxvi, 9.
—— **lævis** (Montagu). v. *Vermiculum*, 1803 [v. *Lagenula*].
—— —— [Walker & Jacob]. Williamson, Annals Mag. Nat. Hist. [2], I, 1848, 12, i, 1 and 2.
—— —— —— var. *a* **amphora**, Will. *Ibid.* [2], I, 1848, 12, i, 3 and 4.
—— —— —— Clark, *ibid.* [2], III, 1849, 382, f. [probably a *Nodosaria*].
—— —— —— var. Parker & Jones, *ibid.* [2], XIX, 1857, 278, xi, 22–24 [24 var. *striata*].
—— —— —— Parker & Jones, Phil. Trans. 1865, 353, xviii, 9*a*, *b*, 10, 11, 12*a*, *b*.
—— —— —— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 33, i, 28.
—— —— —— Mackie, Science Gossip, 1867, 130, f. 112.
—— —— [Montf.]. Tate & Blake, Yorkshire Lias, 1876, 453, xviii, 7, 7*a*.
—— —— —— Morris, Lecture Geol. Croydon, [1876], 8, f. 3⁵.
—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 176, i, 4.
—— —— —— Bütschli in Bronn Klassen, etc., Thier-Reichs, 1880, 197, vii, 21.
—— —— —— Green, Amer. Journ. Micros. VI, 1881, 46, pl., 1.
—— —— —— Jones in Micrgr. Dict. ed. 4, 1883, 452, xxiii, 22*a*, *b*.
—— —— —— Brady, Report Challenger, 1884, 455, lvi, 7–14 and 30.
—— —— [Walk. and Jacob]. Jones, Quart. Journ. Geol. Soc. XI, 1884, 769, xxxiv, 3.
—— —— —— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 744, xiv, 13.
—— —— —— Haeusler, Neues Jahrb. 1887, i, 181, iv, 31–50; and v, 31–35; and 53 (?).
—— —— —— Malagoli, Atti Soc. Nat. Modena (Rend.) 3, III, 1887, 109, i, 7.

LAGENA marginata, Walk. & Boys. Green, Amer. Journn. Micros. vi, 1881, 46, pl., 8.
——— ——— ——— Brady, Report Challenger, 1884, 476, lix, 21–23.
——— ——— ——— var. **semimarginata**, Reuss. Brady, *ibid.* 1884, 477, lix, 17 and 19.
——— ——— [W. & J.]. Balkwill & Millett, Journ. Micr. iii, 1884, 81, iii, 2.
——— ——— [W. & J.] (single keel). *Ibid.* iii, 1884, 81, iii, 8 (trigonal form).
——— ——— [W. & J.], var. **pedunculata**, Seg. *Ibid.* iii, 1884, 81, iii, 3 [*Fissurina*, 1862].
——— ——— [W. & J.], v. **inæquilateralis**, Wright. Proc. Belfast Nat. Field Club, 1884–5, App. ix, 1886, 321, xxvi, 10*a*, *b*, *c*.
——— ——— [Mont.]. See *L. sulcata*, W. & J., and *L. vulgaris*.
——— ——— ——— Haeusler, Neues Jahrb. 1887, i, 186, iv, 51–53.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. xii, (7), 1888, 222, xliv, 27, 29, 30 and 32.
——— **marginato-perforata**, Seguenza. Atti R. Acc. Lincei, [3], vi, 1880, 332, xvii, 34.
——— **marginato-radiata**, Seguenza. *Ibid.* [3], vi, 1880, 332, xvii, 35.
——— **mariæ**, Karrer. Abh. k. k. geol. Reichs. ix, 1877, 378, xvi*b*, 16.
——— **maxima**, Dunkowski. Kosmos [Lemberg], iv, 1879, 105, plate, 3 [= *L. globosa*].
——— **melo** (d'Orbigny). J., P. & B., Crag. Foram., Pal. Soc. xix, 1866, 38, i, 35 [*Oolina*, 1839].
——— ——— ——— Mackie, Science Gossip, 1867, 129, f. 109.
——— ——— ——— (bilocular). P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], viii, 1871, 157, ix, 33 [v. *Nodos. cancellata*, d'O.].
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. xii, (7), 1888, 222, xliv, 21, 24, 25 (?).
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, (4), vi, 1889, 112, vi, 1.
——— ——— ——— See *L. sulcata*, W. and J.
——— **minutissima**, Zwingli and Kübler. Foraminif. schweiz. Jura, 1870, 19, ii, Macrocephalusoolith 1 [= *L. globosa*].
——— **mucronata**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], x, 1875, 14, i (xi), 8*a–c*.
——— **mucronulata**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, (1), 1862 (1863), 329, iv, 52.
——— ——— ——— *Ibid.* lxii, 1870, 467, No. 8; v. Schlicht, Foram. Pietzpuhl, 1870, iii, 18 and 24.
——— [**mucronata**, Rss.]. Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 8.
——— **multicostata** (Karr.). Brady, Report Challenger, 1884, 466, lxi, 4 [*Fissurina*, 1877].
——— **natrii**, Tate & Blake. Tate & Blake, Yorkshire Lias, 1876, 453, xviii, 8.
——— **oblonga**, Brown. Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 38 and 39 [*Vermiculum*, 1803].
——— **oblonga** (Seguenza). Wright, Proc. Belf. F. C. 1876–7 (App.), 104, iv, 9 [v. *Trigonulina*, 1862].
——— **orbignyana** (Seg.). Brady, Report Challenger, 1884, 484, lix, 1, 18, 24–26; 20 (winged var.) [v. *Fissurina*, 1862].
——— ——— ——— Balkwill & Millett, Journ. Micr. iii, 1884, 82, iii, 1.
——— ——— ——— (trigonal form). *Ibid.* iii, 1884, 82, iii, 10.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. xii, (7), 1888, 222, xliv, 20.
——— **ornata**, Will. J., P. & B., Crag Foram., Pal. Soc. xix, 1866, 43, i, 29–31 [v. *Entosolenia marginata*].
——— **ornata**, Terquem. Mém. Soc. Géol. France, [3], ii, 1882, 27, i (ix), 12 [Williamson's sp. is referred to].
——— ——— ——— Terq., Bull. Soc. Zool. Fr. xi, 1886, 331, xi, 5.
——— **ovalis**, Kaufmann. In Heer, Urwelt Schweiz, 1865, 196, f. 107; and transl. 1876, 203, f. 107.
——— **ovata**, Terq. Terq. & Berthelin, Mém. Soc. Géol. France, [2], x, 1875, 12, i (xi), 2*a–d* [*Oolina*, 1858].
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 454, xviii, 10.

LAGENA ovata, Terq. Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [18], i, 15–15*b*.

——— (**Obliquina**, Seguenza), **oviformis**, Sherborn & Chapman. Journ. R. Micr. Soc. [2]. VI, 1886, 745, xiv, 19*a*, *b*, *c*, *d* [see *Obliquina*].

——— **ovum** (Ehrenberg). Marsson, Mitth. nat. Ver. Neu-Vorpommern und Rügen, X, 1878, 120, i, 1*a*, *b*, *c* [*Miliola*, 1843].

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——— ——— ——— Toutkowsky, Zap. Kievsk. Obsch. Est. VIII, 1887, 351, iii, 2*a*; iv, 2*b*.

——— **oxystoma**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 334, v, 66 [v. also *L. vulgaris*].

——— **parkeriana**, Brady. Carbonif. Foram., Pal. Soc. XXX, 1876, 120, viii, 1–5 [referred to *L. aspera*, Reuss, in 1884].

——— **parkinsoni**, Zwingli & Kübler. Foraminif. schweiz. 1870, 17, ii, Parkinsonthon 1 [= *L. globosa*].

——— **perlucida** (Montagu). Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 29 [*Vermiculum*, 1803; v. also *L. vulgaris*, var.].

——— ——— ——— Brown, *ibid.* ed. 2, 1844, 3, lvi, 29.

——— ——— [Will.]. Schlumberger, F. Jeun. Nat., Jan. 1882, i, 2.

——— **perovalis**, Gümbel. Abh. m.-ph. Cl. k.-bayer Ak. Wiss. X, 1868 (1870), 606, i, 7.

——— **plumigera**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 62.

——— ——— ——— Brady, Report Challenger, 1884, 465, lviii, 25 and 27.

——— **pulchella**, Brady. Rept. Brit. Assoc. (Nottingham), 1866, 70, not figured.

——— ——— ——— Brady, Annals & Mag. Nat. Hist. [4], VI, 1870, 294, xii, 1*a*, *b*.

——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 19.

——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 82, ii, 13.

——— ——— ——— (trigonal form). *Ibid.* III, 1884, 82, iii, 11.

——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 342, xii, 19.

——— **quadralata**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 62.

——— ——— ——— Brady, Report Challenger, 1884, 464, lxi, 3*a*, *b*.

——— **quadrangularis**, Brady. *Ibid.* 1884, 483, cxiv, 11*a*, *b*.

——— **quadrata** (Will.). Brady, *ibid.* 1884, 475, lix, 3 and 16; lx, 5 [*Entosolenia marginata*, var. 1858].

——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 81, ii, 8.

——— ———? var. *Ibid.* III, 1884, 81, i, 11.

——— **quadricostulata**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, (1), 1870, 469; figured by v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, iv, 25–30.

——— ——— ——— Brady, Report Challenger, 1884, 486, lix, 15 and 17?

——— **quadrigono-clathrata**, Balkwill & Millett. Journ. Micr. III, 1884, 80, iv, 3.

——— **quadrigono-orbignyana**, Balkwill & Millett. *Ibid.* III, 1884, 80, iv, 2.

——— **quinquelatera**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 60.

——— ——— ——— Brady, Beport Challenger, 1884, 484, lxi, 15 and 16.

——— **radiato-marginata**, Parker & Jones. Parker & Jones, Phil. Trans. 1865, 355, xviii. 3*a*, *b* [v. also *L. vulgaris*].

——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 15.

——— ——— ——— Brady, Report Challenger, 1884, 481, lxi, 8 and 9.

——— **reticulata** (Macgill.). Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 333, v, 67 and 68 [*Lagenula*, 1843].

——— ——— ——— Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 144, i, 16.

——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 10.

——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 28, i (ix), 15.

——— **retorta** (Walker & Boys). Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 34 and 35 [*Serpula*, 1784].

——— ——— ——— Brown, *ibid.* ed. 2, 1844, 3, lvi, 34 and 35.

LAGENA rudis, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 336, vi, 82.
——— ——— ——— Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 145, i, 17.
——— **samara**, Brady. Quart Journ. Micr. Sci. XXI, 1881, 61 [referred to *L. siliqua*, Ry. Jones, in 1884].
——— **scalariformis** (Will.). Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 333, v, 69–71 [v. *Entosolenia squamosa*].
——— ——— ——— Jones in Micrögr. Dict. ed. 4, 1883, 452, xxiii, 27.
——— **scarenæensis**, Hantken, Ertek. termesz. köreből, XIII, No. 1, 1883, 24, i, 9*a*, *b*; and Math. Nat. Ber. Ungarn, II, 1884 144.
——— **schulzeana**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 62.
——— ——— ——— Brady, Report Challenger, 1884, 482, lxi, 10.
——— **seguenziana**, Fornasini. Boll. Soc. Geol. Ital. v, 1886, (fas. 3, 1887), 350, viii, 1–6, and intermediate var., figs. 7 and 8.
——— **semi-alata**. Balkwill & Millett. Journ. Micr. III, 1884, 81, ii, 9.
——— **semilineata**, Wright. Proc. Belfast Nat. Field Club, 1884–5, App. ix, 1886, 320, xxvi, 7.
——— **seminiformis**, Schwager. Novara-Exped., Geol. II, 1866, 208, v, 21.
——— ——— ——— Brady, Report Challenger, 1884, 478, lix, 25–30.
——— **seminuda**, Brady. *Ibid.* 1884, 472, lviii, 34*a*, *b*.
——— **semi-ornata**, Terquem. Bull. Soc. Zool. Fr. XI, 1886, 330, xi, 2.
——— **semistriata**, Williamson. J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 34, iv, 6 [*L. striata*, Will. var., 1848; *L. sulcata*, *L. vulgaris* and *Lagenulina*].
——— ——— ——— Mackie, Science Gossip, 1867, 130, f. 111.
——— ——— ——— Zittel, Handbuch Palæont. (1), 1876, 85, 21[1].
——— ——— ——— Green, Amer. Journ. Micros. VI, 1881, 46, pl., 2.
——— ——— ——— Jones in Micrógr. Dict. ed. 4, 1883, 452, xxiii, 25.
——— ——— ——— Brady, Report Challenger, 1884, 465, lvii, 14, 16, 17 [18, 20?].
——— ——— ——— Wright, Proc. Belfast Nat. Field Club, 1884–5, App. ix, 1886, 324, xxvi, 6.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, (5), (1885), 1049, lxxxvi, 2.
——— ——— ——— Steinmann, Elem. Paleont. I, 1888, 27, f. 8*A*.
——— ——— ——— See *L. sulcata*, W. & J.
——— **seriato-granulosa**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, (1), 1870, 468; figured by von Schlicht, " Foram. Septar. Pietzpuhl," 1870, xxxvi, 20.
——— **siliqua**, Ry. Jones. Brady, Report Challenger, 1884, 478, lix, 27 [*L. vulgaris*, var. 1872; and also *L. samara*].
——— **simplex**, Reuss. Reuss' Model. No. 55, 1865 (Catal. No. 33, 1861) [*Oolina*, 1851].
——— **simplex**, Terq. Terq. & Berthelin, Mém. Soc. Géol. France, [2], X, 1875, 13, i (xi), 4*a*, *b* [*Oolina*, 1862].
——— **siphoniata**, Gruber. Nova Acta Acad. Cæs. Leop.-Carol. XLVI, 1884, 501, viii, 23–26.
——— **sphærica**, Kaufmann. In Heer, Urwelt Schweiz. 1865, 196, f. 106; and transl. 1876, 203, f. 106.
——— ——— ——— Kübler & Zwingli, Neujahrsblatt Burgersbibl. Winterthur, 1866, 18, iii, 15 [? a single cell of *Globigerina* or *Planorbulina*].
——— **spiralis**, Brady. Report Challenger, 1884, 468, cxiv, 9.
——— **squamosa** (Montagu). Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 32 [*Vermiculum*, 1803, *Entosolenia*, and *E. globosa*].
——— ——— ——— Brown, *ibid.* ed. 2, 1844, 3, lvi, 32.
——— ——— ——— J., P. & B., Crag Foram., Pal. Soc. XIX. 1866, 39, iv, 7.
——— ——— ——— Mackie, Science Gossip, 1867, 130, f. 110.
——— (**Entosol.**) ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 18.
——— ——— ——— Jones in Micrógr. Dict. ed. 4, 1883, 452, xxiii, 26.
——— ——— ——— Brady, Report Challenger, 1884, 471, lviii, 28–31.
——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 340, xiv, 9.

LAGENA sulcata (Walker & Jacob), var. (**Entosolenia**) **apiculata**, Rss. and **caudata**, d'O. *Ibid.* 1865, 358, xiii, 38, 39; xvi, 6–9 [v. *L. apiculata* and *L. caudata*].

——— ——— ——— var. **distoma**, Parker & Jones. *Ibid.* 1865, 356, xiii, 20 [v. *L. distoma*].

——— ——— ——— var. **distoma-polita**, Parker & Jones. *Ibid.* 1865, 357, xiii, 21 [v. *L. distoma-polita*].

——— ——— ——— var. (**Entosolenia**) **globosa**, Mont. Parker & Jones, *ibid.* 1865, 348, xiii, 37*a*, *b*; xvi, 10*a*, *b* [v. *L. globosa*].

——— ——— ——— var. **lævis**, Mont. Parker & Jones, *ibid.* 1865, 349, xiii, 22; xvi, 9*a* [v. *L. lævis*].

——— ——— ——— var. (**Entosolenia**) **marginata**, Mont. Parker & Jones, *ibid.* 1865, 355, xiii, 42–44; xvi. 12*a*, 12*b* [v. *L. marginata*].

——— ——— ——— var. (———) **melo**, d'O. Parker & Jones, *ibid.* 1865, 350, xiii, 33–36 [v. *L. melo*].

——— ——— ——— v. **semistriata**, Will. Parker & Jones, *ibid.* 1865, 350, xiii, 23 [v. *L. semi-striata*].

——— ——— ——— var. (**Entosol.**) **squamosa** (Mont.). Parker & Jones, *ibid.* 1865, 354, xiii, 40, 41; xvi, 11*a*, 11*b* [v. *L. squamosa*].

——— ——— ——— v. **striato-punctata**, Parker & Jones. *Ibid.* 1865, 350, xiii, 25–27 [v. *L. striato-punctata*].

——— ——— ——— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 36, i, 41–43.

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——— ——— ——— var. Dawson, Canad. Nat. n. s. V, 1870, 177, f. 10 [= *gracillima*, Seguenza].

——— ——— ——— var. Dawson, Amer. Journ. Sci. [3], I, 1871, 206, f. 10; and Annals Mag. Nat. Hist. [4], VII, 1871, 86, f. 10.

——— ——— ——— Wright, Proc. Belf. F. Club, 1876-7, (App.), 103, iv, 10.

——— ——— ——— Vine, Science Gossip, 1878, 52, f 27.

——— ——— ——— Nicholson, Manuel Palæont. 1879, I. 114, f. 18. *f*.

——— ——— ——— Brady, Report Challenger, 1884, 462, lvii, 23, 26, 33, 34; lviii, 4, 17 and 18.

——— ——— ——— v. **interrupta**, Will. Brady, *ibid.* 1884, 463, lvii, 25, 27; lviii, 5 and 6 [*L. striata*, v. *interrupta*, 1848].

——— ——— ——— Balkwill & Wright, Trans. R. I. Ac. XXVIII (Sci.), 1885, 338, xiv, 1 and 2.

——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 745, xiv, 18.

——— ——— ——— Hæusler, Neues Jahrb. 1887, I, 183, v, 1–4; and 38, 39 ["*Nodos. raphanus*"?].

——— ——— ——— Brady, Geol. Mag. dec. 3, V, 1888, 481, xiii, 11.

——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 222, xliv, 18, 22, 34.

——— ——— ——— v. **acuticosta**, Rss. B., P. & J., *ibid.* XII, (7), 1888, 222, xliv, 26, 31.

[——— ——— ———] Dawson, Canad. Nat. II, 1857, vii, 22.

——— ——— ——— see *L. vulgaris*.

——— **synedra**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 608, i, 10*a*. *b*.

——— **tenuis** (Bornemann). Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 325, iii, 30–39 [v. *Oolina*].

——— ——— ——— Reuss, Bull. Ac. Roy. Belg. [2], XV, 1863, 141, i, 6–9.

——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 5.

——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 26, i (ix), 8.

——— **tenuiaculeata**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 351, xxv, 28 [error for 27].

——— **tenuistriata**, Stache. Novara-Exped., Geol. (1), 1864, 184, xxii, 5*a*, *b* [error for 4].

——— **tetragona**, Parker & Jones. Phil. Trans. 1865, 352, xviii, 14*a*, *b*.

——— **torquata**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 62.

——— ——— ——— Brady, Report Challenger, 1884, 469, lviii, 41.

——— **transverso-costata**, Toll. Mém. Ac. Imp. Sci. St. Pétersbourg, [7], XXXVII, No. 3, 1889, 52, v, 10, 18.

LAGENA vulgaris [Parker & Jones], v. **semistriata**, Will. Reuss, *ibid.* [2], xv, 1863, 141, i, 3–5 [v. *L. semistriata*].
——— ——— ——— Williamson, Pop. Sci. Rev. IV, 1865, 173, viii, 4.
——— ——— ——— Reuss' Model. No. 16, 1865 (Catal. No. 34, 1861).
——— ——— ——— Cooke, Thousand Objects Microsc. 1869, 91, ix, 14.
——— ——— ——— Terquem, Mém. Ac. Imp. Metz, LI, 1870, 349, xxv, 21, 22 [error for 20, 21].
——— ——— ——— Chimmo, Bed of Atlantic, 1870, 17, iii, 1; 28, x, 3 and 4.
——— ——— ——— v. **perlucida** [Mont.]. Chimmo, *ibid.* 1870, 28, x, 4*a* [v. *L. perlucida*].
——— ——— ——— Ry. Jones, Trans. Linn. Soc. xxx, 1872, 51, xix, 10–13.
——— ——— ——— v. **alato-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 60, xix, 44.
——— ——— ——— v. **ampulla-distoma**, Ry. Jones. *Ibid.* xxx, 1872, 63, xix, 52 [v. *L. ampulla-distoma*].
——— ——— ——— v. **apiculata**, Rss. Ry. Jones, *ibid.* xxx, 1872, 50, xix, 3–5 [v. *L. apiculata*].
——— ——— ——— v. **bicamerata**, Ry. Jones. *Ibid.* xxx, 1872, 65, xix, 60–62.
——— ——— ——— v. **bracteato-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 59, xix, 40, 41.
——— ——— ——— v. **caudata**, d'Orb. Ry. Jones, *ibid.* xxx, 1872, 54, xix, 22 [v. *L. caudata*].
——— ——— ——— v. **clavato-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 60, xix, 45.
——— ——— ——— v. **clypeato-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 58, xix, 37.
——— ——— ——— v. **desmophora**, Ry. Jones. *Ibid.* xxx, 1872, 54, xix, 23, 24 [v. *L. desmophora*].
——— ——— ——— v. **distoma-patera**, Ry. Jones. *Ibid.* xxx, 1872, 65, xix, 58.
——— ——— ——— v. **distoma-polita**, Parker & Jones. Ry. Jones, *ibid.* xxx, 1872, 64, xix, 53–57 [v. *L. distoma-polita*].
——— ——— ——— v. **fissurina**, Rss. Ry. Jones, *ibid.* xxx, 1872, 51, xix, 6–8.
——— ——— ——— v. **glacialis**, Ry. Jones. *Ibid.* xxx, 1872, 52, xix, 14.
——— ——— ——— v. (**Entosol.**) **globosa**, Mont. Ry. Jones, *ibid.* xxx, 1872, 49, xix, 1 and 2 [v. *L. globosa*].
——— ——— ——— v. **gothica**, Ry. Jones. *Ibid.* xxx, 1872, 51, xix, 9.
——— ——— ——— v. **helophoro-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 61, xix, 48.
——— ——— ——— v. **hispida**, Rss. Ry. Jones, *ibid.* xxx, 1872, 62, xix, 50 [v. *L. hispida*].
——— ——— ——— v. **janeta**, Ry. Jones. *Ibid.* xxx, 1872, 65, xix, 59, 59*a*.
——— ——— ——— v. **marginata**, Mont. Ry. Jones, *ibid.* xxx, 1872, 55, xix, 27–32 [v. *L. marginata*].
——— ——— ——— v. **pertuso-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 61, xix, 46, 47.
——— ——— ——— v. **petasma-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 58, xix, 38, 39.
——— ——— ——— v. **radiato-marginata**, Parker & Jones. Ry. Jones, *ibid.* xxx, 1872, 57, xix, 33 [v. *L. radiato-marginata*].
——— ——— ——— v. **semistriata**, Will. Ry. Jones, *ibid.* xxx, 1872, 52, xix, 15 [v. *L semistriata*].
——— ——— ——— v. **siliqua**, Ry. Jones. *Ibid.* xxx, 1872, 61, xix, 49 [v. *L. siliqua*].
——— ——— ——— v. **spinicosto-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 57, xix, 34–36.
——— ——— ——— v. **spinoso-marginata**, Ry. Jones. *Ibid.* xxx, 1872, 59, xix, 42, 43.
——— ——— ——— v. **squamosa**, Will. Ry. Jones, *ibid.* xxx, 1872, 63, xix, 51 [v. *L. squamosa*].
——— ——— ——— v. **striata**, Mont. Ry. Jones, *ibid.* xxx, 1872, 52, xix, 16–20, [v. *L. striata*].
——— ——— ——— v. **striato-areolata**, Ry. Jones. *Ibid.* xxx, 1872, 53, xix 21, 21*a*.

LAGENULA, Montfort, 1808. Conch. Syst. 1808, 311. M
——— **flosculosa**, Montfort. *Ibid.* I, 1808, 311, 78th genre [= *Lagena suaac* v. *flosculosa* ?].
——— **lævis** (Walk.). Fleming, Hist. Brit. Anim. 1828, 235 [v. *Lagena*].
——— **reticulata**, MacGill. Hist. test. anim. Aberdeen, etc. 1843, 38 [v. *Lagena*].
——— Fleming, Hist. Brit. Anim. 1828, 234, 235, quotes Walker's, and Montagu's *Lagenæ* under this genus.
——— Thorpe, Brit. Mar. Conch. 1844, 233–235, quotes Walker's, and Montagu's *Lagenæ* under this genus.
——— Zborzewski, Nouveaux Mém. Soc. Imp. Nat. Moscou, III, 1834, 311, xxviii, *c*.
LAGENULINA, Terquem, 1876. Essai Animaux plage Dunkerque, (2), 1876, 67; (and Mém. Soc. Dunkerquoise) [= *Lagena*].
——— **costata** (Will.). Terq., *ibid.* (2), 1876, 67, vii, 2; (and Mém. Soc. Dunkerquoise [*Entosolenia*, 1858].
——— **filicosta** (Reuss). Terq., *ibid.* (2), 1876, 67, vii, 5 and 7 [var. 6]; (and Mém. Soc. Dunkerquoise) [*Lagena*, 1862].
——— **globosa** (Walk.), [Montagu]. Terq., (2), *ibid.* 1876, 67, vii, 3 and 4; (and Mém. Soc. Dunkerquoise); [*Vermiculum* 1803].
——— **semistriata** (Will.). Terq., *ibid.* (2), 1876, 68, vii, 8; (and Mém. Soc. Dunkerquoise) [*Lagena striata*, var. 1848].
——— **striata** (d'Orb.). Terq., *ibid.* (2), 1876, 68, vii, 7; (and Mém. Soc. Dunkerquoise) [*Oolina*, 1839].
——— **sulcata**, Terquem. *Ibid.* (2), 1876, 68, vii, 9; (and Mém. Soc. Dunkerquoise).
? ——— Terquem, Bull. Soc. Géol. France, [3], VIII, 1880, 418, xi, 7 [cast].
LAGYNIS, Schultze. Siddall, Cat. Brit. Rec. Foram. 1879, 3, includes this genus in the Foraminifera.
LAMARCKINA, Berthelin. C. R. Assoc. Franç (Reims, 1880), p. 555 [founded on *Pulvinulina erinacea*, Karrer.]
LAMPAS trithemus, Montfort. Conch. syst. I, 1808, 243, 61st genre [= *Crist. cultrata*, deformed].
LAPIDIS nummalis, Brückmann. Epist. Itin. XXXVII, de Foss. Blanckenburgicis, 1739, 10, ii, f. ii [*Nummulites*].
LAPIS frumentarius Helveticus cinereus semina melonum, etc. Lange, Hist. Lapidum Figuratorum, 1708, 69, xviii [*Nummulite*].
——— ——— ——— **niger** ——— ——— *Ibid.* 1708, 69, xviii [*Nummulite*].
——— ——— Scheuchzer, v. *Lentes lapideæ*.
LARVARIA = *Polytrypa* = *Dactylopora*, q. v.
——— **reticulata**, Defr. Dict. Sci. Nat. xxv, 1822, 287, figured in Blainville, Actinol. 1834, xvii, 3.
LATERICIA ovalis, Schafhäutl. Geogn. Unters. sudbay. Alpengeb. 1851, 49, xiii [misprinted in text xviii], f. 17; [an "oolite granule;" may be *Lagena*].
LEKITHIAMMINA, de Folin, 1881. Bull. Soc. Nat. Hist. Toulouse, XV, 136, not described; five species proposed.
LEMISTRIATA, Green, 1881, see *Lagena semistriata*.
LENS striata in utrinque convexa, Scheuchzer. Misc. Cur. Ac. Leop.-Cæs. III, 1697–8, 63, f. *j*; Spec. lithog. Helvet. 1702, 30, f. 46–48; beschr. naturges. Schweiz. I, 1706, 102, viii, 46–48; Itin. Alpina, 1723, 4th voyage, 200, f. 4 and 5; and 7th voyage, 478, f. 4 and 5.
LENTES lapideæ, Scheuchzer. Natur. Historie Schweitz, 1718, 326, f. 158 [and ? f. 75] [*Nummulites*].
——— **lapideæ convexoplanæ**, Volkmann. Silesia subter. 1720, 331, plate "*P* iii, *Tab.* ii," 5 [*Nummulites*].
——— ——— Scheuchzer, *Θυρεσιφοντης helveticus*, 1723 [= *Nummulites*].
LENTICOLE, Targioni. Relagione d'alc. viaggi, etc. IV, 1770, vii, pl. 1, f. 2, *a*, *b*, *c* [=*Nummulites*].
LENTICULÆ diversi generis admixtæ cum nautiliæ et ammoniis, Soldani. Sagg. Oritt. 1780, 105, iii, 29, *z*; iv, 30, *B* [= *Nummulites*].

LENTICULITES [planularis, Lam.]. Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls., 1837), 17, viii, 1.
——— [**planatus**] ——— Quenstedt, Handbuch Petref. ed 3, (5), (1885), 1054, lxxxvi, 30 and 31.
——— **rotulata**, Lamarck. Ann. Mus. v, 1804, 188, No. 3; and f 11, pl. 62, in vol. VIII, 1806 [v. also *Lenticulina* and *Nummulina* = *Cristellaria*].
——— ——— ——— Lamarck, Ency. Méthod. "Vers" (pls., 1827) (P. & J. quote "part 23, 1816), II (1830), 330, pl. 466, f. 5.
——— ——— ——— Lamarck, Coq. Foss. Paris, 1823, 14, xiv, 11.
——— ——— ——— Crouch, Introd. Lamarck, 1827, 41, xxii, 6.
——— **variolaria**, Lamarck. Ann. Mus. v, 1804, 187, No. 2 [referred by d'Archiac to *Nummularia variolaria*, Sowerby, q. v.]
——— Bowdich. Elem. Conch. (1), 1822, 22, ii, 17.
——— Pilla. Trattato di Geol. (1), 1847, 461, f. 79 [= *Nummulites*].
LENTICULUM discus. Ehr. Hopkins, Execut. Doc. 45 Congress, Sess. 3, v, iv, Rpt. Chief Engineers, (2), App. W, 1878–79, 885, ii, 69 [= *Planorbulina*].
LENTICULAM in eodem saxo inventam, Soldani. Sagg. Oritt. 1780, 105, iv, 31*C*, *D* [= *Nummulites*].
LENTILLES de bethlehem, Knorr. Receuil de monuments, II, (1), 1775, 53 [= *Nummulites*].
——— **petrifiée**, Sage. Journ. de Phys. LX, 1805, 222 [= *Nummulites*].
LEPIDOCYCLINA, Gümbel, 1868. Abh. k.-bayer. Ak. Wiss. x, (2), 1868, 689. This subgenus of *Orbitoides* was proposed by Gümbel for the following forms: *L. mantelli* (Morton); *L. dilatata* (Michelotti); *L. burdigalensis* (Gümbel).
LIARDS, Sage. Journ. de Phys. LX, 1805, 222 [= *Nummulites*].
LICHENOPORA cribrosa, Reuss. Verst. Böhm. Kreide, 1845–6, II, 64, xiv, 10; xxiv, 3–5 [v. also *Polyphragma*].
? ——— **pupa**, Gümbel. Geogn. Beschr. bayer. Alpengeberges, I, 1861, 654 [v. *Gaudryina*].
LIEBERKUEHNIA, Claparède & Lachmann, 1859. Mém. Inst. Nat. Genevois, XVI, 1859, 464.
——— **wageneri**, Claparède & Lachmann, *ibid.* XVI, 1859, 465, xxiv (error for xxiii); Carpenter, Introd. Foram. 1862, 28 and 63, ii; Brady, Report Challenger, 1884, 60.
LIMOCÆCUM, de Folin, 1881. Bull. Soc. Nat. Hist. Toulouse, XV, 139; not described, one species proposed.
LINGALINA, Mackie, 1867, error for *Lingulina*.
LINGULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 256; Brady, Report Challenger, 1884, 517.
——— **alata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 2.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 162, ix, 63.
——— ——— ——— see *Orthoceratia Zoophytica subcordiformia*.
——— **ampullacea**, Costa. Microdoride Mediterranea, 1861, 45, viii, 1.
——— **bohemica**, Reuss. Verstein. Böhm. Kreide, 1845–6, II, 108, xliii, 10.
——— **brevis**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, (1), 1870, 478; v. Schlicht "Foram. Septar. Pietzpuhl," 1870, xxvi, 19–24.
——— **bursæformis**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 628, i, 51*a*, *b*.
——— **carinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 1 [v. *Nodosarina*].
——— ——— ——— D'Orb., Modèles, No. 26, 1826.
——— ——— ——— D'Orb., In Barker-Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, (2), "Foraminifères," 124, i, 5 and 6.
——— ——— ——— D'Orb., In de la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 20, i, 13 and 14; also in Spanish, 1840, 48, same pl. and fig.
——— ——— ——— Pictet, Traité de Paléont. IV, 1846, 220, xii, 4.
——— ———? ——— Costa, Atti Accad. Pontaniana, VII, (2), 1856, 175, xvi, 2 [error for 25] *a*, *A*, *B*, *C* [= *L. carinata*, d'O.].
——— ——— ——— Williamson, Recent British Foram. 1858, 14, ii, 33–35.
——— ——— ——— Jones & Parker, Quart. Journ. Geol. Soc. XVI, 1860, xix, 13–15.

LINGULINA carinata, d'Orbigny. Jones, Geologist, VI, 1863, 294, xv, 14–15
——— ——— ——— P., J. & B. [d'Orb., Modèles, 26], Ann. Mag. Nat. Hist. [3], XVI, 1865, 23, i, 28.
——— ——— ——— Brady, Proc. Somerset. Arch. & Nat. Hist. Soc. XIII, 1865–6 (1867), 223, i, 10.
——— ——— ——— Mackie, Science Gossip, 1867, 130, f. 118.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 164, ix, 61 and 62 (dimorphous, var) [see *Marginulina*].
——— ——— ——— Brady, Report Challenger, 1884, 517, lxv, 16 and 17.
——— ——— ——— v. **seminuda**, Hantk. Brady, *ibid.* 1884, 518, lxv, 14 and 15 [*L. costata*, var., 1875].
——— ——— ——— Balkwill & Millett, Journ. Micr. III, 1884, 83, iv, 6.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 161, f.
——— ——— ——— see *Nautilus* (*O*) *vaginæformis*, Batsch.
——— ——— ——— see *Testæ ovales*, etc., and *Nautili amphorarii.*
——— **cordiformis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 340, xxv, 6.
——— **costata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 62, iii. 1–5.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, III, 1853–56, 238, xxxv^{2}, 38*a*, *b*, *c*.
——— ——— ——— Carpenter, Parker & Jones, Introd. Foram. 1862, xii, 1.
——— ——— ——— Suess, Boden Stadt Wien, 1862, 45, f. 1^{2}.
——— ——— ——— Karrer, Novara-Exped., Geol. (1), 1864, 75, xvi, 3.
——— ——— ——— Reuss' Model. No. 64, 1865 (Catal. No. 56, 1861).
——— ——— ——— v. **seminuda**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 35, iv, 8*a*, *b*; and Mitth a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 41, same pl. and. fig. [var. *subglabra* in descr. of plate].
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxix, 11*a*, *b*, *c*.
——— ——— ——— Zittel, Handbuch Palæont. (1), 1876, 85, f. 21^{6}.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 7.
——— ——— ——— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, vii, 23.
——— ——— ——— Quenstedt, Handbuch Petref., ed. 3, (5), (1885), 1051, lxxxvi, 14.
——— ——— ——— Hoernes, Elem. Palæont. 1884, 25, f. 8; French ed., 1886, same fig.
——— **decipiens**, Stache. Novara-Exped.. Geol. (1), 1864, 193, xxii, 17*a*, *b*.
——— **decipiens**, Schwager. Pal. Indica, [13], No. 7, 1887, 991, cxxviii, 11*a*–*d*.
——— **dentaliniformis**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 339, xxv, 1–3 [cf. *Frond. dentaliniformis*].
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 12, i, 27–29.
——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [23], ii, 10–10*b*.
——— **dolium**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 340, xxv, 4 and 5 [cf. *Frond. dolium*].
——— **elisa**, Schwager. Jahresh. Ver. vat. Nat. Würtl XXI, 1865, 115, iv, 20, 20*a*.
——— **glabra**, Hantken. A magy. kir földt. int. évkönyve, IV, 1875 (1876), 35, xiii, 14; and Mitth. a. d. Jahrb. k. ungar. geol Anstalt, IV, 1875 (1881), 42, same pl. and fig.
——— **glans**, Stache. Novara-Exped., Geol (1), 1864, 191, xxii, 14.
——— **gracillima**, Costa. Microdoride Mediterranea. 1861, 48, viii, 7*B*.
——— **hasta**, d'Orb. Jones, Cat. Foss Foram. B. M. 1882, p. 40 [v. *Mucronina*].
——— **impressa**, Terquem. Mém. Soc. Géol. France, [3], II, 1882, 38, i (ix), 45*a*, *b*.
?——— **intumescens**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 182, vi, 27.
——— **intustriata**, Stache. Novara-Exped., Geol. (1), 1864, 190, xxii, 13*a*, *b*.
——— **lata**, Gümbel. Gümbel, Anleit. geol. Beob. Alpenreisen Zeitschr. D. & O. Alpenver. Beilage, 1878, 105, f. 25^{23}.
——— **lebelli**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 149, vi, 3.
——— **makowskyiana**, Rzehak. Verh. nat. Ver-Brünn, XXIV, 1885 (1886), 97, i, 7.

LINGULINA mediterranea, Costa. Microdoride Mediterranea, 1861, 47, viii, 7.
——— **multicostata**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 146, ii, 6*A*, *B*.
——— **mutabilis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 61, ii, 52–54.
——— **mutinensis**, Coppi. Boll. Com. Geol. Ital, VII, 1876, 208, no fig.
——— **mutinensis**, Doderlein, MS. Malagoli, Atti Soc. Nat. Modena, Mem. 3, VII, 1888, 5, i, 6, 7 and 8.
——— **nodosaria**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 59, v, 12*a*, *b*.
——— ——— ——— Berthelin, Mém. Soc. Géol. France, [3], I, 1880, 64, iv (xxvii), 10*a–c*
——— **ovalis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 116, iv, 21–24.
——— **ovalis**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], X, 1875, 23, i (xi), 27.
——— **papillosa**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII, 2, 1856, 97, v, 6*a*, *b*.
——— **polymorpha**, Costa. Microdoride Mediterranea, 1861, 46, viii, 2–6, and 8.
——— **propinqua**, Stache. Novara-Exped., Geol. (1), 1864, 191, xxii, 15*a*, *b*, *c*, *d*.
——— **pygmæa**, Reuss. In Geinitz, Palæontographica, XX, (2), 1874, 89, xx, 23.
——— **rimosa**, Stache. Novara-Exped., Geol. (1), 1864, 192, xxii, 16*a*, *b*.
——— **rotundata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 61, ii, 48-51.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 171, ii, 4.
——— **semiornata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 91, xii, 11*a*, *b*.
——— **soldanii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 3.
——— ——— ——— = *Grammost. pennatula* (Batsch), see *Orthoceras pupa* [= *Vulvulina* = *Bigenerina capreolus* (d.O.)].
——— **striata**, Tate & Blake. Yorkshire Lias, 1876, 455, xviii, 16, 16*a*.
——— **subacuta**, Gümbel. Anleit. geol. Beob. Alpenreisen Zeitschr. D. & O., Alpenver. Beilage, 1878, 105, f. 25[24].
——— **tenera**, Bornemann. Lias von Göttingen, 1854, 38, iii, 24 *a–c* [v. *Frondicularia*].
——— ——— ——— Brady, Proc. Somerset. Arch. & Nat. Hist. Soc. XIII, 1865–6 (1867), 223, i, 11.
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 455, xviii, 15, 15*a*.
——— **tetragona**, Terquem. Mém. Ac. Imp. Metz, LI, 1870, 341, xxv, 7 and 8.
——— **tuberosa**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 629, i, 52*a*, *b*.
——— sp. Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 297, vi, 7.
[——— **carinata**], Costa. Fauna Regno Napoli, 1838, "Foraminiferi," not descr., iii, 5.
[———**?**], Costa. *Ibid.* 1838, "Foraminiferi," not descr., iv, 15.
LINGULINOPSIS, Reuss, 1860. Reuss, Sitz. k böhm. Ges Wiss. 1860, 23.
——— **bohemica**, Reuss. Reuss' Model. No. 30, 1865 (Catal. No. 57, 1861) = [a linguline *Marginulina*].
——— **carlofortensis**, Bornemann. Atti Soc. Tosc. Sci. Nat. VI, (1), 1884, 26, vi, 1–7 [see Seguenza, Nat. Sicil. III, 1884, 135].
——— **furcillata**, Berthelin. Mém. Soc. Géol. France, [3], I, 1880, 65, iv (xxvii), 6*a–c*.
——— **rediviva**, Berthelin. *Ibid.* [3], I, 1880, 65, iv (xxvii), 7*a*, *b*.
——— **seguana**, Berthelin *Ibid.* [3], I, 1880, 63, ii (xxv), 19*a–c*.
——— **stillula**, Berthelin. *Ibid.* [3], I, 1880, 64, iv (xxvii), 8*a–9b*.
——— **striata**, Reuss. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 29 [v. *Amphimorphina*].
LINTHURUS, Montfort, 1808.
——— **cassidatus**, Montfort. Conch. syst. I, 1808, 255, 64th genre [= *Cristellaria*].
——— **cassis** (F. & M.). Defrance, Dict. Sci. Nat. XXVI, 1823, 555; XXXII, 1824, 188; Atlas, Conch. XIX, 3 [*Nautilus*, 1798].

LITUOLA [**nautiloides**] Lam. Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 381, ii [error for xi], 3.
——— ——— ——— D'Orbigny, Mém. Soc. Géol. France, [1], IV, 1840, 29, ii, 28–31; Facsimile in Science Gossip, 1870, 107, f. 112.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 138, xxi, 20 and 21.
——— ——— ——— D'Orbigny, Cours élém. Paléont., etc. I, 1849, 198, f. 324; II, (2), 1852, 687, f. 559.
——— ——— ——— Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 5–7.
——— ——— ——— Dixon, Geol., etc., Sussex, 1850, 352, xxvii, 14 [error for 12 and 13]; and ed. 2, 1878, 285, pl. 30, 12 and 13.
——— ——— ——— Bronn, Lethæa Geognostica, ed. 3, II, 1851–52, 87, xxix[1], 14*a*, *b*.
——— ——— ——— Jones, Lecture Geol. Hist. Newbury, 1854, 48, ii, 4, 4*a*.
——— ——— ——— Mantell, Medals Creation, ed. 2, 1854, 347, f. 111, 3*a–d*.
——— ——— ——— Mantell, Wonders Geol. 1857, 7th ed., 335, f. 65, 1.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XL, 1860, 220, x, 5, 6*a*, *b*, 7 and 8.
——— ——— ——— Carpenter, Parker & Jones, Introd. Foram. 1862, 144, vi, 44–46.
——— ——— ——— Jones, Geologist, VI, 1863, 294, xv, 12.
——— ——— ——— v. **canariensis** (d'O.). Parker & Jones, Phil. Trans. 1865, 406, xv, 45*a*, 45*b*; xvii, 92–95 [v. *L. canariensis*].
——— ——— ——— var. **globigeriniformis**, P. & J. *Ibid.* 1865, 407, xv, 46, 47; xvii, 96–98 [v. *L. globigeriniformis*].
——— ——— ——— var. **scorpiurus** (Montf.). *Ibid.* 1865, 407, xv, 48*a* and 48*b* [v. *L. scorpiurus*].
——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 63, viii, 7.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 87.
——— ——— [d'Orb.]. Bütschli in Bronn, Klassen, etc., Thier Reichs, 1880, 192, v, 18.
——— ——— ——— var. (**Haplophrag.**) **depressa**, Jones. Quart. Journ. Geol. Soc. XL, 1884, 765, xxxiv, 2.
——— ——— see *Fossilia minima*, etc., and *Naut. circumradiati*.
——— **ovata** (v. Hagen.). Marsson, Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, X, 1878, 171, v, 40*a–m* [*Orbignyna*, 1842].
——— **rotundata**, Howchin. Journ. R Microsc. Soc. 1888, 536, viii, 5, 6.
——— **rugosa**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 185, No. 755 [*Robulina*, 1826].
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 242, ix, 31.
——— **scorpiurus** (Montf.). Brady, Trans. Linnean Soc. XXIV, 1864, 467, xlviii, 5 [*Reophax*, 1808].
——— ——— ——— Brady, Nat. Hist. Trans. Northumb. I, 1865–67 (1867), 96, xii, 3.
——— ——— ——— Dawson, Canad. nat. n. s., V, 1870, 177, f. 4.
——— ——— ——— P., J. & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 159, ix, 29.
——— ——— ——— Dawson, Amer. Journ. Sci. [3], I, 1871, 206, f. 4; and Annals Mag. Nat. Hist. [4], VII, 1871, 86, f. 4.
——— **soldanii**, Jones & Parker. Quart. Journ. Geol. Soc. XVI, 1860, 307, No. 184 [v. *Haplostiche*].
——— ——— ——— Carpenter, Parker & Jones, Introd. Foram. 1862, vi, 42 and 43.
——— **soldani**, P. & J., v. **intermedia**. Vanden Broeck. Ann. Soc. Belge Micros. II, 1876, 74, ii, 1, 3, 4 and 6; and Fonds de la Mer, III, (1876).
——— **subglobosa**, M. Sars. Forh. Vidensk. Selsk. Christiania, 1868 (1869), 250 [not described] [v. *Haplophragmium*].
[———], Deshayes, Coq. Foss. Paris, 1837, not descr., cv, 9–18, 20–23, 28–31, 33 and 34.
——— Carpenter, Parker & Jones, Introd. Foram. 1862, 143, vi, 39–47; xi, 11–14 [structural].
——— Terquem, Bull. Soc. géol. France, [3], IV, 1876, 508, xiii, 3.

LOFTUSIA, Steinmann, Palæontographica, xxv, 1878, 117.
? ——— v. Möller. Jahrb. k. k. geol. Reichsanstalt, xxx, 1880, 578, ix, 1–5 [see *L. carbonica*].

LOXOSTOMUM, Ehrenberg. Bigenerine *Textularia*, tending towards *Sagrina rugosa* (*Heterostomella*, Reuss). Aperture entire · · · and lipped as in *Uvigerina*. Edges of shell aculeate. (Parker & Jones, Annals, IX, 1872, 293).
——— **aculeatum**, Ehr. Mikrogeologie, 1854, xxvii, 21 and 22; xxviii, 26 [= Bigenerine *Textularia*, near *Sagrina rugosa*, d'O., = *Heterostomella*, Reuss].
——— **anglicum**, Ehr. *Ibid.* 1854, xxviii, 19 [= *Vulvul. pennatula*, Batsch].
——— **curvatum**, Ehr. *Ibid.* 1854, xxviii, 18 [= probably *Vulvul. pennatula*, Batsch].
——— **rostratum**, Ehr. *Ibid.* 1854, xxvii, 20 [= Bigenerine *Text. agglutinans*].
——— **subrostratum**, Ehr. *Ibid.* 1854, xxvii, 19 [= Bigenerine *Text. agglutinans*].
——— **tumens**, Ehr. *Ibid.* 1854, xxviii, 25; and xxxi, 29 [= *Heterostom. aculeata* (Ehr.)].
——— **vorax**, Ehr. *Ibid.* 1854, xxviii, 24 [*Polym. compressa*].

LUNULITES, Lamarck, 1816. Extract Cours Zool. 1812, 26; and Hist. Anim. s. Vert. II, 1816, 194] a genus of Polyzoa, some species of which have a strong external resemblance to *Nummulites*].
——— **dactioloides**, Owen. Rep. Mineral lands, Niagara Group, 1840 [referred by S. A. Miller, Catal. Amer. Pal. Foss. 1877 to *Receptaculites*].

LYCOPHRIS, Montfort, 1808. Conch. Syst. I, 1808, 159.
——— **dispansus**, Sowerby. Trans geol. Soc. Lond. [2], v, 1837 (1840), 327, 718, and explan. of plates, xxiv, 16, 16*a*, *b* [v. also *Nummulina*, *Nummulites* and *Orbitoides*; referred to *Orbitoides prattii*],
——— ——— ——— Carter, Annals & Mag. Nat. Hist. [2], XI, 1853, 172, vii, 23–29.
——— ——— ——— Carter, Journ. Bombay Br. R. Asiatic Soc. v, (18), (1853), 136, ii, 23–29.
——— ——— ——— Carter, Geol. Papers Western India, 1857, 451, xviii, 16, 16*a*, 16*b*, and 545, xxiii, 23–29.
——— **ephippium**, Sowerby. Trans. geol. Soc. Lond. [2], v, 1837 (1840), 327, and explan. of plates, xxiv, 15, 15*a*, *b* [v. also *Orbitoides*].
——— ——— ——— Carter, Geol. Papers Western India, 1857, 451, xviii, 15, 15*a*, 15*b*.
——— **faujasii**, Defrance. Dict. Sci. Nat. XXIV, 1822, 271 [v. *Hymenocyclus*].
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, (5), (1885), 1056, lxxxvi, 39.
——— **[lenticularis]**, Blainville. Dict. Sci. Nat. 1816–30, Atlas, Zooph. xlix, 3 [v. also *Nummulites*] [= *Orbitoides*] (not *Lycophris lenticularis* of Montfort).
——— **[lenticularis]**, Blainville. Malacol. 1825, lxxiv, 3 [= *Orbitoides*] (not *Lycophris lenticularis* of Montfort).
——— **lenticularis**, Montfort. Conch. syst. I, 1808, 159, 40th genre [= *Nummulina perforata* (*N. lucasana*)].
——— ——— ——— Bronn, Syst. urweltl. Pflanzenthiere, 1825, 29, vii, 11*a–c* [= *Numm. scabra*].
——— ——— ——— Basterot, Mém. Soc. Hist. Nat. Paris, II, (1), 1825, 19, vii, 3.

LYRINA, Zborzewski, 1834. Nouveaux Mém. Soc. Imp. Nat. Moscou, III, 1834, 311 ["obscure two-celled form," P. & J.].
——— **fischeri**, Zborzewski. *Ibid.* III, 1834, 311, xxviii, 3*a*, *b*. *c*.

MACRODITES cucullatus, Montfort. Conch. syst. I, 1808, 239, 60th genre [= *Cristellaria*].

MADREPORITES, Deluc, Journ. Physique, LVI, 1802, 325, etc., plate, figs. 7–12 [*Orbitolites*].
——— **lenticularis**, Blumenbach. Abbild. Nat. Gegenstände, (8), No. 80, 1805, lxxx [= *Patellina concava* (Lam.) [v. *Orbulites*].

MALLOPELA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 140; not described, 5 sp. proposed; and Congrès Scient. Dax, 1882 (1883), 328, not described; La Naturaliste, IX, 1887, 113, f

MARGINULINA bifurcata, d'Orbigny. Ann. Sci. Nat. VII, 1826, 258, No 2.
——— **bigibbosa**, Terquem. Bull. Soc. d'Hist. Nat. Moselle, XI, 1868, 118, vii, 26*a*, *b*; var. *A*, 27 [v. *M. gibbosa*].
——— **bijuga**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 404, viii, 20*a*, *b*.
——— **biplicata**, Terquem. *Ibid.* XLIV, 1863, 397, viii, 1 [7] *a*, *b*, *c*, *d*, *e*.
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—— **inæquistriata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 401, viii, 15*a-f*.

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—— **inepta**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. II, 1851, 127, iv, 14 [= *inversa*, Neugeb., 1860].

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—— **inflata**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. II, 1851, 132, v, 9.

—— **inflexa**, Neugeboren. *Ibid.* II, 1851, 126, iv, 11.

—— **interamniæ**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 184, xiii, 9*a*, *A*

—— **interlineata**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 617, iii, 11*a*, *b*.

—— **intermedia**, Neugeboren. Ver. Mitth. siebenburg. Ver. Nat. II, 1851, 140, v, 19 [= *variabilis*, Neugeb., 1860].

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——— **modesta**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 207, vii, 5.

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——— **nilssonii**, Roemer, figured as *Nodos. lævigata*, Nilsson in "Petrif. Suec. form. cretac." 1827, ix, 20 (Roemer, Verst. n. d. Kreide, 1840, 96).

——— **nitida**, v. Hagenow. Neues Jahrb. f. min. 1842, 569.

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——— **opaca**, Stache. Novara-Exped., Geol. (1), 1864, 214, xxii, 47*a*, *b*.

——— **orbignyana**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. II, 1851, 122, iv, 7 [= *M. attenulata*, Neugeb., 1860].

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——— **ornatissima**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 209, vii, 2*a–d*.

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——— **parallela**, Terquem. Sixième Mém. Foram. Lias, 1866, 499, xxi, 3*a*, *b*.

——— **parkeri**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 59, v, 14*a*, *b*.

——— **partschiana**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. II, 1851, 131, iv, 18 [= *M. similis*, d'Orb., Neugeb., 1860].

——— **parvipes**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 21.

——— **pauci-loculata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 76, xiv, 10*a*, *b*; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 47, same pl. and fig.

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——— **pellucida**, Stache. Novara-Exped., Geol. (1), 1864, 217, xxii, 51 [50 on plate by error]

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—— **recta**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 39, iv, 15; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 47, same pl. and fig.
—— **regularis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 68, iii, 9-12.
—— **renggeriana**, Deecke. Mém. Soc. Emul. Montbéliard, XVI, 1886, [28], i [error for ii], 30, 30*a*.
—— **resupinata**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 117, iv, 28.
—— **reussiana**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. II, 1851, 123, iv, 8 [= *M. attenuata*, Neugeb., 1860].
—— **reussiana**, Jones MS. Wright, Proc. Belfast Nat. Field Club, 1884-5, App. ix, 1886, 331, xxvii, 6.
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——— **costatus**, Montagu. Testac. Brit. 1803, 199, xiv, 5 [= *Nodosaria*].
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——— ——— ——— Wood, Index Testaceologicus, 1825, 64, xiii, 25.
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——— **crassulus**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Micros. 1798, 641, xiv, 35 [Walker's, *Nautilus spiralis crassus*, iii, 70 = *Nonion. crassula*, W. & J] [v. *Polystomella*].
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——— ——— ——— Wood, Index Testaceologicus. 1825, 66. xiii, 53.
——— **crispus**, Linn. Syst. Nat. ed. 10, 1758, 709; ed. 13 (Gmelin's), 1788, 3370 [Plancus, de Conch. 10, t. 1, f. 2 [v. *Polystomella*].
——— ——— ——— Martini, Neues Syst. Conchyl.-Cab. I, 1769, 250, xx, 172–174.
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——— ——— ——— Walker & Jacob, in Kannmacher's ed. of Adams' Essays Micros. 1798, 640, xiv, 30 [Walker's *Nautilus spiralis geniculis crenatis*, iii, 65].
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NAUTILUS crispus, Linn. Parkinson, Organ. Rem. former World, III, 1811, 107, xi, 25.

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——— **cum ammoniis admixti**, Soldani. Sagg. Oritt. 1780, 100, ii, 14–16 [14 = ? *Biloculina*; 15 = *Adelosina lævigata*; 16 *VX* = *Rot. schreibersii*; 16 *TT* to *XX* = *Nonionina pompilioides*].

——— **seu margine coronato dentali**, Sold. *Ibid.* 1780, 98, i, 5*H* [= *Crist. calcar*].

——— **depressulus**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Micros. 1798, 641, xiv, 33 [Walker's *Nautilus spiralis utrinque*, etc. iii, 68 = *Nonion. depressula*, W. & J.].

——— ——— ——— Montagu, Testac. Brit. 1803, 190; and Supplement, 1808, 78, xviii, 9.

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——— ——— ——— Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 3.

——— **discors**, Spalowsky. Testac. 1795, 8, i, 8.

——— **diversæ speciei**, Soldani. Sagg. Oritt. 1780, 134, xviii, 90*M*, *N*, *O*; 91*P*, *Q*, *R*, *S*; xix, 91*T*, *V*, *X* [90*M*, *N* = *Crist. costatus*; *O* = *Crist. calcar*; 91*P*, *Q* = *C. cultrata*, many chambers; *R* = *Crist. crepidula*; *S* = *Alveolina boscii*; *T* = *Frondic. complanata*; *VX* = ? *Globig. bulloides*]

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——— **echinus**, Sold. Testac. I, (1), 1789, 64, pl. 57, *T* [*Cristellaria marginata*, d'O., Ann. Sci. Nat. VII, 1826, 291, 7].

——— **entrochus**, Schrœter. Wiedemann's Archiv, III, (2), 1803, 60, no fig. [? *Dentalina*]

——— **faba**, Fichtel & Moll. Test. Micr. 1798, 103, xix, *a–c* [v. *Nonionina*].

——— ——— ——— Wood, Index Testaceologicus, 1825, 66, xiii, 51.

——— **farctus**, Fichtel & Moll. Test. Micr. 1798, 64, ix, *g–i* [= *Planorbulina farcta* (F. & M.)].

——— **fascia**, Linn. Syst. Nat. ed. 10, 1758, 711; ed. 13 (Gmelin's), 1788, 3373 [Gaultieri, Test. t. 19, f. *O* [v. *Nodosaria*].

——— **fascia**, Brookes. Introd. Study Conch. 1815, 93, v, 57.

——— ——— ——— Brookes, Anleit. Conch. 1823, 80, v, 57.

——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 31.

——— **galea**, Fichtel & Moll. Test. Micr. 1798, 100, xviii, *d–f* [= *Cristellaria*].

——— ——— ——— Wood, Index Testaceologicus, 1825, 66, xiii, 49.

——— **gazellicornis**, Spalowsky. Testac. 1795, 9, i, 9.

——— (**Orthoc.**) **globifer**, Batsch. Conch. Seesands, 1791, iii, 9*a*–9*c* [= *Nodos. globifera*, Batsch.].

——— **globuli**, Sold. Testac. I, (1), 1789, 66, pl. 59, *vv* [*Robulina soldanii*, d'O., Ann. Sci. Nat. VII, 1826, 288, 5].

——— **globuli**, Sold. *Ibid.* I, (1), 1789, 66, pl. 59, *tt* [*Robulina vortex* (F. & M.), d'Orb., Ann. Sci. Nat. VII, 1826, 288, 4].

——— **gyzehensis**, Forskal. Descript. Anim. 1775, 140; Icones rerum nat. 1776 [probably the same as *Nummulites gyzensis*, Ehrenberg].

——— **granum**, Linn. Syst. Nat. ed. 10, 1758, 711, ed. 13 (Gmelin's), 1788, 3372.

——— (**O.**) **harpa**, Batsch. Conch. Seesands, 1791, v, 14*a*–14*e* [14*a* = *Frond. complanata*, Defr.; 14*b*, *c* = *Flab. harpa*, Batsch; 14*d*, *e* = *Planularia auris*, Defr.].

——— **helicites**, Schrœter. Voll. Einleit. Stein, etc. IV, 1784, 232, x, 2.

——— ——— ——— Linn., Syst. nat. ed. 13 (Gmelin's), 1788, 3371.

——— **hystrix marginatus**, Sold. Testac. I, (1), 1789, 64, pl. 57, *S* [*Cristellaria marginata*, d'O. Ann. Sci. Nat. VII, 1826, 291, 7].

——— **inæqualis**, Gmelin. Linn., Syst. Nat. ed. 13 (Gmelin), 1788, 3373 [Spengler, Dansk. Skr. 1781, 373, t. 2, f. 10*a*, *b*, *c* [v. *N. rectus*].

——— **inæqualis**, Wood. Index Testaceologicus, 1825, 65, xiii, 32.

——— **incrassatus**, Fichtel & Moll. Test. Micr. 1798, 38, iv, *a–c* [= *Nonion. incrassata* (F. & M.).

——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 40.

——— **inflatus**, Montagu. Testac. Brit. Supplement, 1808, 81, xviii, 3 [v. *Rotalina* and *Trochammina*].

NAUTILUS inflatus, Montagu. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 4.

——— **jugosus**, Montagu. Testac. Brit. 1803, 198, xiv, 4 [v. *Orthocera*].

——— **læves (Lenticulæ)**, Sold. Testac. I, (1), 1789, 44, pl. 33, *nn* [*Robulina rosacea*, d'O. Ann. Sci. Nat. VII, 1826, 289, 11].

——— **læves (Lenticulæ)**, Sold. *Ibid.* I, (1), 1789, 54, pl. 33, *mm* [*Robulina marginata*, d'O., Ann. Sci. Nat. VII, 1826, 288, 6].

——— **lævi-lucido-umbilicati**, Soldani. Sagg. Oritt. 1780, 99, i, 11*o* [= *Crist. cultrata*].

——— **lævigatulus**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Micros. 1798, 641, xiv, 32 [Walker's *Nautilus spiralis geniculis lævibus*, iii, 67 = *Crist. rotulata*, Lam.] [v. *Rotalia*].

——— ——— ——— Montagu, Testac. Brit. 1803, 188; and Supplement, 1808, 75, xviii, 7 and 8.

——— ——— ——— Wood, Index Testaceologicus, 1825, 63, xiii, 6.

——— ——— ——— Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 9 and 10.

——— **legumen**, Linn. Syst. Nat. ed. 10, 1758, 711; ed. 13 (Gmelin's), 1788, 3373 [Plancus, *Cornu Hammonis*, de Conch. 8, t. 1, f. 7 [v. *Orthocera*, *Nodosarina*, *Dentalina* and *Vaginulina*].

——— ——— ——— after Plancus, Gualteri and Ledermuller. Fornasini, Bol. Soc. Geol. Ital. v, 1886, cuts, *aA*, *bB*, *cC*, on p. 26.

——— **legumen**, Montagu. Testac. Brit. Supplement, 1808, 82, xix, 6 [v. *Spirolina*].

——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 34.

——— **(Orthoceras) leguminiformis**, Batsch. Conch. Seesands, 1791, iii, 8*a*, 8*b* [8*a* = *Vag. leguminiformis*, Batsch; 8*b* = *Dent. communis*, d'Orb.].

——— **lenticula**, Sold. Testac. I, (1), 1789, 66, pl. 60, *yy* [*Robulina rotundata*, d'O. Ann. Sci. Nat. VII, 1826, 290, 24.

——— **(Lenticulæ marginatæ)**, Sold. *Ibid.* I, (1), 1789, 54, pl. 33, *B*, etc. [*Robulina cultrata* (Montf.), d'Orb. Ann. Sci. Nat. VII, 1826, 287, 1].

——— **(Lenticulæ) marginatæ**, Sold. *Ibid.* I, (1), 1789, 54, pl. 33, *D* [*Robulina marginata*, d'O., Ann. Sci. Nat. VII, 1826, 288, 6.

——— **(Lenticulæ radiatæ)**, Sold. *Ibid.* I, (1), 1789, 54, pl. 33, *aa* [*Robulina pulchella*, d'O., Ann. Sci. Nat. VII, 1826, 288, 8].

——— **(Lenticulæ radiatæ)**, Sold. *Ibid.* I, (1), 1789, 54, pl. 33, *bb* [*Robulina radiata*, d'Orb., Ann. Sci. Nat. VII, 1826, 288, 7].

——— **lenticularis**, Fichtel & Moll. Test. Micr, 1798, 55, var. *α*, pl. vi, *e–h* [= *Numm. tchihatcheffi*), d'A. and H.; var. *β*, vii, *a*, *b* [= ? *Numm. lucasana*, Defr.]; var. *γ*, vii, *c–f* [= ? *Numm. molli*, d'A.]; var. *δ*, vii, *g* [= ? *Numm. biaritzensis*, d'A.] [not *N. radiata*, d'O.]; var. *ε*, vii, *h* [= ? *Numm. perforata*, (Montf.), d'O.].

——— **linearis**, Montagu. Testac. Brit. Supplement, 1808, 87, xxx, 9 [v. *Orthocera*, *Nodosarina* and *Vaginulina*].

——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 35.

——— **littoreus**, Wulfen. Nova Acta Acad. Cæs. Leop. Carol. VIII, 1791, 241, no fig.

——— **lituitati**, Soldani. Sagg. Oritt. 1780, 97, i, 1*a–c* [= *Crist. cassis*].

——— **lituitatus**, Sold. Testac. II, 1798, 13, pl. 1, *A* [*Cristellaria tuberculata*, d'O. Ann. Sci. Nat. VII, 1826, 292, 21].

——— **lituitati**, Sold. *Ibid.* I, (1), 1789, 64, pl. 57, *z*; 58, *aa* [*Cristellaria lanceolata*, d'O. For. Foss. Vienne, 1846, 89, iii, 41, 42].

——— ——— ——— *Ibid.* I, (1), 1789, 64, pl. 57, *x* [*Cristellaria consecta*, d'O. Ann. Sci. Nat. VII, 1826, 290, 1].

——— ——— ——— *Ibid.* I, (1), 1789, 64, pl. 58, *bb* [*Planularia crepidula* (F. & M.), d'O. Ann. Sci. Nat. VII, 1826, 260, 6] [= *Cristellaria*, q. v.].

——— ——— ——— *Ibid.* I, (1), 1789, 64, pl. 56, *O*, *P* [*Cristellaria nitida*, d'O. Ann. Sci. Nat. VII, 1826, 291, 4].

——— ——— **cuspides**, Sold. *Ibid.* I, (1), 1789, 64, pl. 58, *dd* [*Planularia rostrata*, d'O. Ann. Sci. Nat. VII, 1826, 260, 7] [= *Cristellaria*, q. v.].

——— ——— **cuspis**, Sold. *Ibid.* I, (1), 1789, 64, pl. 58, *cc* [*Cristellaria elongata*, d'O. Ann. Sci. Nat. VII, 1826, 292, 11].

——— **lituitatus ligulæ**, Sold. *Ibid.* I, (1), 1789, 64, pl. 57, *z* [*Cristellaria bilobata*, d'O. Ann. Sci. Nat. VII, 1826, 292, 12].

NAUTILUS planatus, Fichtel & Moll. Wood, Index Testaceologicus, 1825, 66, xiii, 47.
——— **planci**, Wulfen. Nova Acta Acad. Cæs. Leop. Carol. VIII, 1791, 246, no fig. [founded on Plancus, de Conch, tab. 1, f. 4] [= *Crist. rotulata*].
——— **(Orthoc.) pennatula**, Batsch. Conch. Seesands, 1791, iv, 13*a*–13*c* [v. *Grammostomum*, *Vulvulina*, *Bigenerina*, *Capreolus*].
——— **pertusus**, Forskal. Descr. Anim. 1775, 125, No. 65 [v. also *Peneroplis*].
——— **pompilioides**, Fichtel & Moll. Test. Micr. 1798, 31, ii, *a–c* [= *Nonionina*].
——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 37.
——— **prorsus microscopici, quos gibbosos, seu papyraceos minimos voco**, etc., Soldani. Sagg. Oritt. 1780, 101, ii, 18*A* [= *Truncat. tuberculata*].
——— **radiatus**, Fichtel & Moll. Test. Micr. 1798, 58, viii, *a–d* [= *Nummulina radiata* (F. & M.) = *N. variolaria*, Lamarck].
——— **radicula**, Linn. Syst. Nat. ed. 10, 1758, 711; ed. 13 (Gmelin's), 1788, 3373 [Plancus, de Conch. 14, t. 1, f. 5] [v. *Orthocera*, *Nodosarina* and *Nodosaria*].
——— ——— ——— Montagu, Testac. Brit 1803, 197, vi, 4; xiv, 6.
——— ——— ——— Wood, Index Testaceologicus, 1825, 64, xiii, 27.
——— **(Orthoc.) radicula**, Batsch. Conch. Seesands, 1791, iii, 10*a*, *b* [= *Nodos. limbata*, d'O.].
——— **raphanistrum**, Linn. Syst. Nat. ed. 10, 1758, 710; ed. 13 (Gmelin's), 1788, 3372 [v. *Nodosaria*].
——— ——— ——— Wood, Index Testaceologicus, 1825, 64, xiii, 23.
——— ——— ——— Hanley, Ipsa Linn. Conch. 1855, 490, v, 4.
——— **raphanus**, Linn. Syst. Nat. ed. 10, 1758, 711; ed. 13, (Gmelin's), 1788, 3372 [Plancus, de Conch. t. 1, f. 6] [v. *Orthocera*, *Marginulina*, *Nodosarina* and *Nodosaria*].
——— ——— ——— Wood, Index Testaceologicus, 1825, 64, xiii, 24.
——— **rectus**, Spengler. Nye Saml. k. Danske Selsk. Skr. I, 1781, 381, ii, 10*a*, *b*, *c*.
——— ——— ——— *Ibid* I, 1781, 382, ii, 10*d*, *e*, *f* ["Den anden Art (Lit. *d*, *e*, *f*) er meget merkværdig."].
[**NAUTILUM rectum**], Schrœter. Neue Litt. u. Beytr. I, 1784, 316, i, 8.
——— **rectus**, Montagu. Testac. Brit. 1803, 197; and Supplement, 1808, 82, xix, 4 and 7 [v. *Orthocera*].
——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 36.
——— **rectus geniculis depressis**, Walker & Boys. Test. Min. [1784], 21, iii, 74 [*Nod.* (*Vagin.*) *legumen*, Linn.].
——— **repandus**, Fichtel & Moll. Test. Micr. 1798, 35, iii, *a–d* [= *Pulvinulina repanda* (F. & M.)].
——— ——— ——— Wood, Index Testaceologicus, 1825, 65, xiii, 38.
——— **rotatus** [Montagu]. Wood, *ibid.* 1825, 63, xiii, 5.
——— **rugosus**, Linn. Syst. Nat. ed. xii, 1766, 1162; ed. 13 (Gmelin's), 1788, 3371.
——— **(Orthoceras) scalaris**, Batsch. Conch. Seesands, 1791, ii, 4*a*, *b* [v. *Nodosarina* and *Nodosaria*].
——— **scapha**, Wulfen. Nova Acta Acad. Cæs. Leop. Carol. VIII, 1791, 242, no fig. [*C. rotulata* ?].
——— **scapha**, Fichtel & Moll. Test. Micr. 1798, 105, xix, *d–f* [v. *Polystom. crassula*, var.; *Nonion. scapha* (F. & M.); *N. communis*, d'O., is this form].
——— ——— ——— Wood, Index Testaceologicus, 1825, 66, xiii, 52.
——— **sceptrum**, Schrœter. Wiedermann's Archiv, III, (2), 1803, 61, no fig. [? *Nodosaria*].
——— **semilituus**, Linn. Syst. Nat. ed. 10, 1758, 710; ed. 13 (Gmelin's), 1788, 3372 [Columna, Phytobas. 136, t. 38, f. *D* [*Cornu hammonis*].
——— ——— ——— Spalowsky, Testac. 1795, 10, i, 10.
——— **semilituus**, Montagu. Testac. Brit. 1803, 196; and Supplement, 1808, 80, xix, 3.
——— ——— ——— Wood, Index Testaceologicus, 1825, 64, xiii, 19.
——— **semilunares**, Soldani. Sagg. Oritt. 1780, 97, i, 2*d*.
——— **sertum**, Wulfen. Nova. Acta Acad. Cæs. Leop. Carol. VIII, 1791, 240, no fig. [probably *R. beccarii*].

NAUTILUS subarcuatulus, Walker. Parkinson, Organ. Rem. former World, III, 1811, 109, xi, 30.

—— **(Seminula) tricostulati**, Sold. Testac. I, (1), 1789, 62, pl. 53, *A*, *B* [*Cristellaria* (*Saracenaria*) *italica*. Defr. D'Orb., Ann. Sci. Nat. VII, 1826, 293, 26].

—— **tuberosus**, Fichtel & Moll. Test. Micr. 1798, 111, xx, *g–k* [= *Planorbulina tuberosa* (F. & M.)] [v. *Truncatulina*].

—— —— —— Wood, Index Testaceologicus, 1825, 66, xiii, 55.

—— **umbilicatus**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Micros. 1798, 641, xiv, 34 [Walker's *Nautilus spiralis umbilicatulus*, iii, 69 = *Trunc. lobatula*, v. *umbilicatula*, W. & J.] [v. *Rotalia*].

—— —— —— Montagu, Testac. Brit. 1803, 119; and Supplement, 1808, 78, xviii, 1.

—— —— —— Wood, Index Testaceologicus, 1825, 64, xiii, 12.

—— —— —— Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 8.

—— **umbilicatus**, Linn. Syst. Nat. ed. 10, 1758, 710; ed. 13 (Gmelin's), 1788, 3371 [Columna, Phytobas. 136, t. 38, f. *E*].

—— **unguiculatus**, Gmelin. *Ibid.* ed. 13 (Gmelin's), 1788, 3372 [Spengler, Dansk. Skr. 1781, 373, t. 2, f. 9*d*] [= *Calcarina*].

—— —— —— Wood, Index Testaceologicus, 1825, 64, xiii, 18.

—— **(Orthoceras) vaginæformis**, Batsch. Conch. Seesands, 1791, iii, 7*a*–7*d* [7*a* = *Lingul. carinata*; 7*b*, *Lingul.* or *Gland.*; 7*c*, *d*, *Marginulina* sp. ?].

—— **venosus**, Fichtel & Moll. Test. Micr. 1798, 59, viii, *e–h* [= *Nummulina venosa* (F. & M.) = *N. variolaria*, Lamarck].

—— **(Orthoceras) vertebralis**, Batsch. Conch. Seesands, 1791, ii, 6*a*, *b* [v. *Dentalina* and *Nodosaria*].

—— **vortex**, Fichtel & Moll. Test. Micr. 1798, 33, ii, *d–i* [= *Crist.*; d'Orbigny's *Rob. orbicularis* and *R. imperatoria* are varieties of this form] [v. *Cristellaria*].

—— Sold. Testac. II, App. 1798, 145, pl. 18, 91*p*, *P*, *Q* [*Soldania carinata*, d'O. Ann. Sci. Nat. VII, 1826, 281, 1].

—— Sold. *Ibid.* I, (1), 1789, 59, pl. 47, *E* [*Robulina lævigata*, d'O. Ann. Sci. Nat. VII, 1826, 288, 9].

[NAUTILITÆ], Sold. *Ibid.* I, (1), 1789, 66, pl. 60, *B* [*Nonionina umbilicata*, d'O. Ann. Sci. Nat. VII, 1826, 293, 5].

—— see *Ammonia* and *Orthoceras*.

NEMOPHORA floridana, Conrad. Smithson. Misc. Coll. VII, No. 200 (May, 1866), 1 [= ? *Cristellaria*].

NODASARIA, Schlumberger, 1874, misprint for *Nodosaria*.

NODOSARIA, Lamarck, 1812. Extrait Cours Zool. 1812, 121; and Hist. Anim. sans Vert. VII, 1822, 596; Brady, Report Challenger, 1884, 488.

—— **(Gland.) abbreviata**, Neugeb. Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 745, xiv, 20*a*, *b* [*Glandulina*, 1850].

—— **(Dent.) abnormis**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 134, ii, 10 [v. *Dentalina*, 1863].

—— **abyssorum**, Brady. Quart. Journ. Micros. Sci. XXI, 1881, 63.

? —— —— —— Brady, Report Challenger, 1884, 504, lxiii, 8 and 9.

—— **acicula** (Lam.). Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 275, i, 1 [*Orthocera*, 1822].

—— **acicula**, Philippi. Tertiär. nordwest. Deutsch. 1843, 39, i, 33.

—— **acicula**, Reuss. Reuss, in Geinitz. Palæontographica, XX, (2), 1874, 82, xx, 10.

—— **(Dent.) aciculata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 255, No. 41.

—— —— —— —— = *Dentalina*, see *Orthoceras cuspis*.

—— **ackneriana**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 41, i, 17 and 18 [= *N. orbignyana*, Neugeb., 1860].

—— **aculeata**, Ehrenberg. Bericht. k. preuss. Ak. Wiss. Berlin, 1844, 93.

—— —— —— Ehr., Mikrogeologie, 1854, xxix, 42 [near *N. hispida*, d'O.].

—— **aculeata**, d'Orb. Foram. Fossiles Vienne, 1846, 35, i, 26 and 27.

—— —— —— Rss, Versteiu Böhm. Kreide, 1845–6, I, 28, xiii, 29 [= *Dentalina*].

—— **acuminata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 23, ii, 9; xiii, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 28, same pl. and fig.

NODOSARIA antennula, [Costa]. Silvestri, Atti Accad. Giœnia Sci. Nat. n. s. VII, 1872, 89, xi, 252–259.
——— **antipodum**, Stache. Novara-Exped., Geol. (1), 1864, 194, xxii. 19.
penninica, Michelotti. Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III, (2), 1847, 12, not figured.
——— **appendiculata**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 142, xii, 22*a*, *A*.
——— (**Dent.**) **approximata**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 134, ii, 22 [v. also *Dentalina*].
——— ——— ——— ——— Hantken, Magyar. Földt. Társ. Munkálatai, IV, 1868, 87, i, 10.
——— ——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 203, x, 13–15.
——— **archiaciana**, Gemmellaro. Atti Accad. Giœnia Sci. Nat. (2), XV, 1860, 283, i, 8*a*. ["This plate was never published;" *fide* Sig. J. Bertuni, Sec'y Giœnia Acad. Catania, 21 June, 1887].
——— (**Dent**) **arcuata**, d'O., v. *Dentalina*; v. *Orthoceras intortum*, etc.
——— **armata**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 56, i. 44.
——— (**Gl.**) **armata**, Reuss. Brady, Report Challenger, 1884, 494, lxiii, 6 [*Glandulina*, 1865].
——— **arundinea**, Schwager. Novara-Exped., Geol. (2), 1866, 211, v, 43, 44 and 45.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 747, xiv, 28 and 29.
——— **aspera**, Reuss. Verstein. Böhm. Kreide, 1845–6, I, 26, xiii, 14 and 15.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 653, xxiv, 4.
——— **aspera**, Silvestri. Atti Accad. Giœnia Sci. Nat. n. s VII, 1872, 76, viii, 191–200.
——— **aspera**, Terq. & Berthelin. Mém. Soc. Géol. France, [2], x, 1875, 19, i (xi), 18*a*, *b*.
——— **asperula**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 54, i, 40 and 41.
——— **bacilloides**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 86, i, 9*a*, *b*, *c*.
——— ——— ——— Hantk., Magy. kir. földt. int. évk. IV, 1875 (1876), 22, ii, 8; xvi, 6; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt. IV, 1875 (1881), 27, same pl. and fig.
——— **bacillum**, Defrance. Dict. Sci. Nat. XXXV, 1825, 127; XXXVI, 1825, 487; Atlas Conch. xiii, 4.
——— ——— ——— Blainville, Malacol. 1825 (pls , 1827), v, 4.
——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. x), 35, xv, 12.
[——— **bacillum**, Defr.]. Costa, Fauna Regno Napoli, 1838, Foraminiferi, not descr., iv, 7.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 40, i, 40–47.
——— ——— ——— Costa, Mem. Acc. Sci. Napoli, II, 1855 (1857), 134, i, 7*a* *B*, *C*.
——— ——— ——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 72, vi, 14*a–e*.
——— ——— [d'Orb.]. Mackie, Recreative Science, I, 1859, 148, f. 18.
——— ——— ——— Suess, Boden Stadt Wien, 1862, 45, f. 1[1].
——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 618, i, 30.
——— ——— ——— Schlumberger, Compt. Rend. Assoc. France, 1873 (1874), 562, f. 14 and 15.
——— ——— ——— v. **minor**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 21, ii, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 26, same pl. and fig.
——— ——— ——— Bütschli, in Bronn, Klassen, etc., Thier-Reichs, 1880, 197, viii, 14.
——— ——— ——— Schlumberger, F. Jeun. Nat. Jan., 1882, i, 5, and ii, 5.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 748, xiv, 34.
——— ——— ——— See *Orth. seu tubuli*, etc , and *Orth. perfecte conica*, etc.; [*Nodosaria*, sections of], *Orth. brevissima*, etc., and *Orth. perfecte globularia*, etc.

NODOSARIA callidula, Franzenau. Math. termész. értesitö, VII, 1889, 252, iv, 5.
——— **cancellata**, d'Orbigny. Ann. Sci. Nat VII, 1826, 254, No. 29.
——— ——— ——— = *Lag. melo*, d'O. (bilocular), q. v.; v. also *Orthoceratia flosculi.*
——— **candei**, d'Orbigny. De la Sagra, Hist. Phisiq., etc., Cuba, 1839, "Foraminifères," 15, i, 6 and 7; also in Spanish, 1840, 44, same pl. and fig.
——— **cannæformis**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 364, i, 2*a*, *b*.
——— **capillaris**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat III, 1852, 50, i, 22–24.
——— **capitata**, Boll. Geogn. deutsch. Ostseeländer, 1846, 177, ii, 13 [v. also *Dentalina*].
——— ——— ——— v. **brevis**, Reuss. Sitz. k Ak. Wiss. Wien, LXII, (1), 1870, 475; figured by v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, viii, 9.
——— ——— ——— v. **costata**, Reuss. *Ibid.* LXII, (1), 1870, 475; figured by v. Schlicht, "Foram. Septar. Pietzpuhl," 1870, viii, 10.
——— ——— ——— v. **striatissima**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 204, x, 4 and 5.
——— **capitata**, Buvignier. Stat. Géol., etc., Meuse, 1852, Atlas, 47, xxxii, 28.
——— **carinata**, Reeve. Conch. System. II, 1842, 293, ccxcvii, 14 [*Lingulina*, d'Orb. = *Lingulina*].
——— (**Dent.**) **carinata**, d'O., v. *Dentalina*; v. *Orthoceras obliquum*.
——— **catenulata**, Brady. Report Challenger, 1884, 515, lxiii, 32–34.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 486, xi, 21, 22.
——— **catesbyi**, d'Orbigny. De la Sagra, Hist. Phisiq. etc., Cuba, 1839, "Foraminifères." 16, i, 8–10; also in Spanish, 1840, 45, same pl. and fig.
——— **cingillum**, Kübler & Zwingli. Neujahrsblatt. Burgersbibl. Winterthur, 1866, 7, i, 3.
——— ——— ——— Zwingli & Kübler, Foraminif. schweiz. Jura, 1870, 5, i, Turnerithon, 2.
——— **citriformis**, Schmid. Neues Jahrbuch, 1867, 586, vi, 52 and 53.
——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 126, x, 16.
——— **clausa**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, x, 1878, 131, i, 8.
——— **clava**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 276, i, 4.
——— **clava**, Cornuel. Mém. Soc. Geol. France, [2], III, 1848, 250, i, 16, 17.
——— **clava**, Costa. Atti Accad. Pontaniana, VII, (2), (1856), 147, xiii, 7.
——— **clava**, Karrer. In von Drasche, Frag. Geol. Luzon, 1878, 90, v, 11; and Boll. Com. Map. Geol. Españ. VII, 1880, 272, *E*, 11.
——— **clavæformis**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 53, i, 38.
——— **clavata**, Costa. Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 748, xiv, 31 [*Vaginulina*, 1855].
——— **clavatus**, Brown. Elem. Foss. Conch. 1843, [21], iii, 8.
——— **claviformis**, Terquem. Sixième Mém. Foram. Lias, 1866, 477, xix, 17 and 18*a*, *b*.
——— ——— ——— Terquem and Berthelin, Mém. Soc. Géol. France, [2], x, 1875, 19, i (xi), 17.
——— **clavulæformis**, Schwager. Boll. R. Com. Geol. Ital. IX, 1878, 521, i, 4.
——— **clavulus**, Lamarck. Ency. Méth. "Vers," 1830 (pls. 1827), pl. 466, f. 3 [P. & J. quote "pt. 23, 1816"] [= *Clavulina*].
——— (**Orthocerina**) ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 255, No. 48; and Modèles, No. 2, 1826.
——— ——— ——— ——— P., J. & B. [d'O., Modèles, 2], Ann. Mag. Nat. Hist. [3], XVI, 1865, 18, i, 25.
——— ——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 160, f.
——— **coarctata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 19, xii, 15; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875, (1881), 24, same pl. and fig.
——— **coccoptycha**, Gümbel. Abh. m.-ph. Cl k.-bayer. Ak. Wiss. x, 1868 (1870), 611, i, 16.

NODOSARIA columella, Karrer. Abh. k. k. Geol. Reichs. IX, 1877, 379, xvi*b*, 21.
—— **comata** (Batsch). Brady, Report Challenger, 1884, 509, lxiv, 1–5 [*Nautilus* (*Orthoceras*), 1791].
—— **commemorabile**, Franzenau. Math. termész. értesitö, VII, 1889, 252, iv, 6.
—— **communis**, d'Orbigny. Reuss, Verstein. Böhm. Kreide, 1845–6, I, 28, xii, 21 [*Dentalina*, 1826].
—— (**Dent.**) —— —— Parker & Jones, Phil. Trans. 1865, 342, xiii, 10.
—— —— —— —— Brady, Report Challenger, 1884, 504, lxii, 19–22.
—— —— —— Agassiz, Three Cruises. "Blake," II, 1888, 166, f. 505.
—— —— —— Goës, Bihang K. Svenska Vet.-Ak. Handl. XV, 1889, ii, 18–26.
—— (**Dent.**) —— v. *Orthoceras farcimen.*
—— **compressiuscula**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 59, i, 54–56.
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—— —— —— v. **monstruosa**, Silvestri. *Ibid.* VII, 1872, 42, iii, 57.
—— **concinna**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 178, i, 3.
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—— —— —— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 126, x, 14.
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—— (**Dent.**) —— —— Parker & Jones, Phil. Trans. 1865, 342, xvi, 3.
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—— —— —— v. **emaciata**, Rss. *Ibid.* 1884, 502, lxii, 25 and 26 [*Dent. emaciata*, 1851].
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—— —— —— Reuss, Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 130, ii, 19–21.
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—— sp. (cfr. *constricta*, Reuss), v. d. Marck, Verh. nat. Ver. preuss. Rheinl. XV, 1858, 56, i, 14.
—— **contorta**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 159, xvi, 2.
—— (**Dent.**) **contorta**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 89, i, 16.
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—— —— —— Hantk., A magy. kir. földt. int. évkön. IV, 1875 (1876), 23, xiii, 4; and Mitth a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 28, same pl. and fig.
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——— **crispata**, Terquem. Sixième Mém. Foram. Lias, 1866, 476, **xix, 9, 10***a*, *b, c*, 11*a, b*.

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——— **cylindracea**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 146, xii, 12 and 14; xiii, 6.

——— **cylindrella**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 222, i, 2.

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——— **czizckiana**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. III, 1852, 52, i, 30 [quoted as *Cziczeckiana* = *Bronnana* by Neugeb., in 1860.]

——— **dacrydium**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 128, i, 13 and 14.

——— (Dent.) **debilis**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 88, ii, 27 [v. also *Dentalina*].

——— **decem-costata**, Egger. Neues Jahrbuch, 1857, 306, xv, 24 and 25.

——— **deceptoria** Schwager. Novara-Exped., Geol. (2), 1866. 212, v. 30.

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——— **gracilis** (d'O). Rss., Verstein. Böhm. Kreide, 1845–6, I, 27, viii, 6 [*Dentalina*, 1840].
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——— **gracillima**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xvi, 22.
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——— (**Dent.**) **grandis**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 131, i, 26–28.
——— **granitocalcarea**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 186 (1870), 613, i, 19.
——— **granulata**, Karrer. In v. Drasche, Frag. Geol. Luzon, 1878, 90, v, 10; and Bol. Com. Map. Geol. Españ. VII, 1880, 272, *E*, 10.
——— (**Dent.**) **granulosa**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, (3), 1884, 202, x, 3.
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——— **intertenuata**, Schwager. Novara-Exped., Geol. (2), 1866, 226, vi, 58.
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——— **irregularis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 32, i. 13 and 14.
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——— **karreri**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 85, i, 8.
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——— **marginata,** Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, x, 1878, 126, i, 5*a*, *b*.
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——— **millepunctata,** Toutkowsky. Zap. Kievsk. Obsch. Est. IX, 1888, 18, ix, 2*a*, *b* [cfr. *Orthocerina ewaldi,* Karst.].
——— **monile,** Ehr. Bericht. k. preuss. Ak. Wiss. Berlin, 1844, 67 and 93; and Mikrogeologie, 1854, xix, 81; and xx, ii, 1 [= *N. filiformis,* d'O.].
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——— ——— ——— Ehr., Mikrogeologie, 1854, xxviii, 3; xxx, 2; and xxxi, 8 [= *N. ovicula*].
——— **monile,** v. Hagenow. Neues Jahrb. f. min. 1842, 568 [v. also *Dentalina*].
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——— (**D.**) **mucronata,** Neug. Brady, Report Challenger, 1884, 506, lxii, 27–31 [*Dentalina,* 1856].
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——— **oblonga**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xiii, 13.
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——— **venusta**, Reuss. Denkschr. k. Ak. Wiss. Wien, i, 1850, 367, xlvi, 5.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, iv, 1875 (1876), 20, xii, 14; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, iv, 1875 (1881), 24, same pl and fig.
——— (**Dent.**) **vermiculum**, Reuss. Denkschr. k. Ak. Wiss. Wien, xxv, 1865, 133, ii, 14 and 15.
——— **verruculosa**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. iii, 1852, 55, i, 43.
——— ——— ——— Brady, Report Challenger, 1884, 509, lxiii. 17 and 18.
——— **vertebralis** (Batsch). Brady, *ibid.* 1884, 514, lxiii, 35; lxiv, 11–14 [*Nautilus* (*Orthoceras*), 1791; v. *Dentalina*].
——— **vulgaris**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 2; and xxxii, ii, 5 [= *N. glabra*, d'O].
——— ——— ——— Mikrogeologie, 1854, xxix, 43*a*, *b* [= *N. subulata*, Reuss].
——— **waageni**, Schwager. Benecke's Geogn. Pal. Beiträge, i, 1868, 655, xxxiv, 6.
——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, xvi, 1886, [23], i, 10.
——— **webbiana**, Reeve. Conch. system, ii, 1842, 294, ccxcvii, 16 [*Marginulina*, d'Orb. = *Marginulina*].
——— **wetzeli**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. ii, (3), 1884, 298, vi, 12.
——— (**Dent**) **zsigmondyi**, Hantken. Magyar Földt. Társ. Munkálatai, iv, 1868, 87, i, 12.
——— **zippei**, Reuss. Geogn. Skizze aus Böhmen, ii, (1), 1844, 210.
——— ——— ——— Reuss, Verstein. Böhm. Kreide, 1845–6, i, 25, viii, 1-3.
——— ——— ——— Jones, Lecture Geol. Hist. Newbury, 1854, 48, ii, 1. 1*a*.
——— ——— ——— Fric, Stud. Gebiete Böhmischen Kreideform. ii, 1877, 150, f. 154.
——— ——— ——— Fric, Arch. Nat. Landesd. Böhmens, vii, 1889, 110, woodcut 156.
——— ——— ——— v. **alternata**, Jones MS. Wright, Proc. Belfast Nat. Field Club, 1884–5, App. ix. 1886, 330, xxvii, 10.
——— sp.? Ehrenberg, Mikrogeologie, 1854, xxxvii, ix. *B*, 1.
——— sp ind., Stache, Novara-Exped., Geol. (1), 1864, 194, xxii, 18; 195, xxii, 20.
——— sp., Schwager, Jahresh. Ver. vat. Nat. Württ. xxi, 1865, 97, ii, 10 and 11; 98, ii, 12; 99, ii, 15.
——— sp., Schwager, Novara-Exped , Geol. (2), 1866, 235, vi, 73 [error for 75].
——— sp. ind., Hantken. A magy. kir. földt. int. évkönyve, iv, 1875 (1876) 23, xii, 12; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, iv, 1875 (1881), 29, same pl. and fig.

NODOSARINA radicula, (Linn.) v **raphanus** (Linn.). *Ibid.* XIX, No. 4, 1882, 20, i, 9 and 10 [*Nautilus*, 1758].
——— ——— ——— v. **scalaris** (Batsch). *Ibid.* XIX, No. 4, 1882, 21, i, 8 [*Nautilus*, 1791].
——— Carpenter, Parker & Jones, Introd. Foram. 1862, 159, xii, 1–7 [structural].
NODOSINELLA Brady, 1876. Carbonif. Foram., Pal. Soc. XXX, 1876, 102.
——— **concinna**, Brady. *Ibid.* XXX, 1876, 106, vii, 11–15.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877. 26, pl., 83.
——— **cylindrica**, Brady. Carbonif. Foram. Pal. Soc. XXX, 1876, 104, vii, 4–7.
——— **digitata**, Brady. *Ibid.* XXX, 1876, 103, vii, 1–3.
——— **index** (Ehrenberg). v. Möller, Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 74, ii 7*a*, *b*; v, 5 [v. *Nodosaria*].
——— **lahuseni**, v. Möller. *Ibid* [7], XXVII, No. 5, 1879, 75, v, 6*a*, *b* and 7.
——— **lingulinoides**, Brady. Carbonif. Foram., Pal. Soc. XXX, 1876, 106, vii, 24 and 25.
——— **priscilla** (Dawson). Brady, *ibid.* XXX, 1876, 105, vii, 8 and 9 [*Dentalina*, 1868]
——— **tenuis**, v. Möller. Mém. Ac. Imp. Sci. St. Petersburg, [7], XXVII, No. 5, 1879, 76, v, 8*a*, *b*.
——— v. Möller, Jahrb. k. k. geol. Reichsanstalt, XXX, 1880, 577, ix. 7*d*.
——— v. Möller, Verh. russ. k. min. Ges. (2), XVI, 1881, ix, 6*d* [error for 7*d*] [in rock section].
NODOTES, misprint for *Nodosaria*. Spratt, Geol. of Malta, etc. 1854.
NOIGERINA, Rzehak, 1888. Misprint for *Uvigerina*.
NONION incrassatus, Montfort. Conch. syst. I, 1808, 211, 53d genre [= *Nonionina*].
NONIONINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 293; Brady, Report Challenger, 1884, 724.
——— **acervata**, Ehr. Bericht. k. preuss. Ak. Wiss. Berlin, 1843, 167.
——— **affinis**, Reuss. Zeitschr deutsch. geol. Ges. III, 1851, 72, v, 32.
——— **aglajæ**. Ehrenberg. Abh k. Ak. Wiss Berlin, 1872 (1873), iv, 3.
? ——— **archetypus**. Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 310 and 337, i, xiii [*Glauconite*].
——— **arctica**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.
——— **asterizans** (Fichtel & Moll), v. *Nautilus* 1798.
——— [**asterisans**] (F. & M.). Parker & Jones, Annals Mag. Nat. Hist. (2), XIX, 1857, 287, xi, 20 and 21.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 217, iv, 78.
——— ——— ——— Brady, Report Challenger, 1884, 728, cix, 1 and 2.*
——— ——— ——— see *Polystom. crispa* (Linn.).
——— ——— see *Florilus*.
——— **astræa**, Ehrenberg, Mikrogeologie, 1854, xxv, ii, *B*, 8 [= ? vide Parker and Jones, Annals, IX, 1872, 288].
——— **attenuata**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 202, xvii, 10*A*, *B*.
——— **badensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 37, iv, Geissberger schicht, 3 [= *Planorbulina*, near *Ammonoides*].
——— **barleeana**. Williamson. Recent British Foram. 1858, 32, iii, 68 and 69 [= *N. umbilicatula*].
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, (2), 1876, 71, viii, 2*a*. *b* (and Mém. Soc. Dunkerquoise)
——— **bathyomphala**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, (1), 1862 (1863), 95, xiii, 1*a*, *b*.
? ——— **bavarica**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 163, iii, i–iv [= young *Amphistegina*] [Glauc.].
? ——— ——— ——— Bronn, Klassen Ordn. Thier-Reichs, I. 1859, 70, viii 6
? ——— ——— ——— Carpenter. Parker and Jones, Introd. Foram. 1862, xxii, 7 [cast] [= *Amphistegina*].
——— **birmenstorfensis**. Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 29, iii, 39 [= probably a *Planorbulina*].
——— **borealis**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 306.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 18.

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CHARLES DAVIES SHERBORN.

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INTRODUCTION.

When studying any group of animals from a systematic point of view, the first fact that forces itself on the notice of the student is that certain forms, identical one with another, have been described under different and even many names by different observers. This, in most cases, has been caused by the describer being ignorant or regardless of the writings of those who have gone before. In no group, perhaps, is this lamentable state of things presented more forcibly than with the Foraminifera; and it was in order to leave no excuse for those who came after me, that I prepared a Bibliography of the subject in 1888, and in 1890 compiled an index to the contents of all publications on this special group known to me as issued up to December, 1889, which Index the Smithsonian Institution has done me the honor to publish. It is now, therefore, quite an easy matter to arrive at the number and names of species of any genus, and, with this help, to examine and compare those forms previously figured and described with the form supposed to be new; for even in the absence of the literature, friends can always supply tracings of the figures described.

It is chiefly to the efforts of William Kitchen Parker, Thomas Rupert Jones, and Henry Bowman Brady, that we owe the clearing up and ordering of the nomenclature of the older authors. Professor Rupert Jones, the prime mover in the work, is happily still with us. So long ago as 1859, the two first-named of these microscopists commenced a series of papers "On the Nomenclature of the Foraminifera" in the "Annals and Magazine of Natural History," and these were continued, as a series, for about fifteen years. Almost all the old authors were reviewed in their turn, and the result was a considerable simplification of specific nomenclature. Brady, whose acquaintance with recent forms is attested by the "Challenger" Report, did still more in this direction; and of later years Axel Goës, of Kisa, Sweden, has tabulated recent and fossil forms around well-marked varieties. This method, previously adopted by Parker and Jones, tends to support the idea of the impossibility of defining a "species" in a group where every individual may be regarded as a "variety."

In the compilation of this Index many references have been given to forms described but not figured: the existence of such names necessarily leads to an incomplete index; it is an easy matter to overlook a name if not accompanied by a figure. As it is, moreover, practically useless to describe a form as new, without a figure, in a group so variable in itself, the great majority of these

names have passed into a deserved oblivion. This is also applicable to many of Ehrenberg's "species," most of which were drawn and figured as preserved in Canada-balsam. In studying this author it must be remembered that, at the time Parker and Jones wrote their paper upon Ehrenberg's "Mikrogeologie," they were perfectly familiar with Foraminifera, both in the free and in the mounted state with both reflected and transmitted lights. Hence their determinations of Ehrenberg's figures may be safely taken as correct. At the same time it must be pointed out that a correction of nomenclature made to one of the figures in the Mikrogeologie does not necessarily refer to any other species of Ehrenberg's bearing the same binominal appellation.

In the cataloguing of Soldani's numerous figures, I had availed myself of Jones and Parker's observations on the subject, when referring the old figures to modern interpretations. Since the completion of my manuscript, Fornasini has published a detailed memoir on Soldani, and to this I must refer the student for further particulars when dealing with any special form.

With regard to the method of reference employed, it will be noted that the name of the original author of a species invariably accompanies that species, or is expressed by its equivalent ———, whenever that species is referred to subsequently to its first appearance. The practice of quotation often adopted in lists, *e. g.*,

Cristellaria cultrata, Brady, Report Challenger, etc.,

when really

Cristellaria cultrata (Montfort). Brady, Report Challenger, etc.,

is meant, is not only troublesome but misleading.

The letter v. is used indiscriminately for *vide* or *varietas;* but, from the position of the letter, the meaning should be easily apparent.

In the compilation of such a book as this we can scarcely hope to approach perfection; and, with this in mind, I gladly availed myself of the offer by my friend Fortescue William Millett, of Marazion, to look over the proofs with a view to *corrigenda* and *additamenta.* The result of the kind offices of Millett and others is presented in a list arranged alphabetically under genera. It remains for me to express my thanks to the Board of Regents of the Smithsonian Institution for publishing my manuscript; to thank especially Professor Rupert Jones, who kindly placed at my disposal the whole of his manuscript notes made while considering the nomenclature question with Parker and Brady; and to thank those friends who have from time to time favored me with their papers and assistance. My thanks are also gratefully tendered to Dr. S. H. Scudder for his kindly interest, and to the "reader" of the Smithsonian Institution, and the printers, to whose patience and acumen in dealing with a difficult manuscript, I am considerably indebted.

C. DAVIES SHERBORN.

NONIONINA crassula (W. & J.) [d'Orb.]. Jones, Microgr. Dict. ed. 4, 1883, 544, xxiv, 18*a*, *b*.
? ——— **crisiæ**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 285.
——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), iii, 8.
? ——— **crystallina**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 285.
——— ——— ——— Ehr., in Koldewey, Zweite Deutsche Nordpolarfahrt, 1874, ii, n. d., i, 4.
——— **dense-punctata**, Egger. Neues Jahrbuch, 1857, 299, xiv, 22 and 23.
——— **depressa** (d'Orbigny). Reuss in Geinitz, Grundr. Verstein. 1845–46, 666, xxiv, 34 [= *Heterostegina*, 1826].
——— **depressula** (Walker & Jacob). Anon, Science Gossip, 1870, 12, f. 29 [*Nautilus*, 1798].
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 218, iv, 77.
——— ——— ——— Brady, Report Challenger, 1884, 725, cix, 6 and 7.
——— ——— ——— Brady, Parker & Jones, Trans. Zool. Soc. XII, (7), 1888, 229, xliii, 25.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, (4), VI, 1889, 119, x, 4.
——— ——— ——— see *Polystom. crispa* (Linn.).
——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 10.
——— **elegans**, Williamson. Recent British Foram. 1858, 35, iii, 74 and 75 [= *Opercul. ammonoides*, Gron.].
——— (cfr.) ——— ——— Tate & Blake, Yorkshire Lias, 1876, 473, xvii, 39.
——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 18.
——— **elyptica**, d'Orbigny. *Ibid.* VII, 1826, 294, No. 16.
——— **erythræa**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 132.
——— **escheri**, Kaufmann. In Heer, Urwelt Schweiz, 1865, 198, f. 110; and transl. 1876, 208, f. 110 [= *Globig. cretacea*].
——— **excavata**, Seguenza. Atti Accad. Giœnia Sci. Nat. [2], XVIII, 1862, 98, i, 4, 4*a*.
——— **exponens**, Brady, Parker & Jones. Trans. Zool. Soc. XII, (7), 1888, 230, xliii, 16.
——— **faba** (Fichtel & Moll). Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 204, iv, 50 [= *Nautilus*, 1798].
——— ——— see *Chrysolus*.
——— ——— ——— see *Polystom. crispa* (Linn.).
——— **falx**, Czjzek. Haidinger's Nat. Abh. II, 1848, 142, xii, 30 and 31 [v. *Pullenia*].
——— **floridana**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 1.
——— **flustrella**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 286.
——— **formosa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 63, vii, 6.
——— **fraasana**, Gümbel. Jahresh. ver. vat. Nat. Württ. XVIII, 1862, 233, iv, 5*a*, *b*.
——— **fusca**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 23.
——— **germanica**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1839, 133, ii, 1*a*–*g*; Transl. Taylor's Scientific Memoirs, III, 1843, 357, vi, 1*a*–*g* [= *N. umbilicatula* (Montagu)].
——— ——— ——— Mantell, Wonders Geol. 1848, 6th ed., 323, f. 59.
——— ——— (———) Joly & Leymerie, Mém. Ac. Sci. Toulouse, [3], IV, 1848, 215, i, 19–21.
——— ——— ——— Hartwig, Magt van het Kleine, 1849, 111, f. 3, and 1866, 102, f. 41; German by Dr. A. Schwartzkopf, 1851, 81.
——— ——— ——— Hartwig, Verh. I. Kl. Koninkl.-Nederland Inst. 3 r. IV, 1852, 115, ii, 4 and 5.
——— ——— ——— Mantell, Medals Creation, ed. 2, 1854, 350, f. 113.
——— **glabra**, Roemer. Neues Jahrbuch, 1838, 392, iii, 66.
——— **globolus**, Eichwald. Lethæa Rossica, I, 1860, 350, xxii, 17*a*, *b*, *c* [v. also *Endothyra*].
——— **globosa**, v. Hagenow. Neues Jahrb. f. min. 1842, 574 [v. *Discorbina*; *Rotalia*].

NONIONINA globulosa, Ehrenberg. Heer, Urwelt Schweiz, 1865, 198, f. 111; and transl. 1876, 208, f. 111 [= *Planorb. ammonoides* and *Pl. ariminensis*, varr.].

—— **græca**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 23.

—— **granifera**, Terquem. Mém. Soc. Géol. France, [3], II, 1882, 42, ii (x), 8*a*, *b*; 9*a*, *b*.

—— **granosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 8.

—— —— —— D'Orbigny, Foram. Fossiles Vienne, 1846, 110, v, 19 and 20.

—— —— —— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 43, ii (x), 10*a*, *b*.

—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 206, iv, 54.

—— **grateloupi**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 19.

—— —— —— De la Sagra, Hist. Phisiq. etc., Cuba, 1839, "Foraminifères," 46, vi, 6 and 7; also in Spanish, 1840, 67, same pl. and fig. [*N. gradeloupi* on plate].

—— **gravinensis**, Nicolucci. Nuovi Ann. Sci. Nat. Bologna, [2], VI, 1846, 200.

—— **helicina**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 123, i, 18 *A*, *B*, *C*.

? —— ?—— —— Costa, Atti Accad. Pontaniana, VII, (2), 1856, not descr., xiv, 13.

—— **hemprichii**, Ehrenberg. Mikrogeologie, 1854, xxiii, 37 [very close to *N. scapha*].

—— —— —— *Ibid.* 1854, xxiii, 46 [= *Rotalia beccarii*, v. *ammoniformis*].

—— **heteropora**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1847, 485.

—— **heteropora**, Egger. Neues Jahrbuch, 1857, 300, xiv, 19–21.

—— **hyalina**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 286.

—— —— —— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 4.

—— **incrassata** (Fichtel & Moll), v. *Nautilus*.

—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 205, iv, 52.

—— —— —— Gümbel, Geol. Bayern, (1), II, 1885, f. 266, 24.

—— **inflata**, Alth. Haidinger's Naturw. Abh. III, (2), 1850, 266, xiii, 22.

—— **integra**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.

—— **jaccardi**, de Loriol. Mém. Soc. Phys. Hist. Nat. Genève, XVIII, (1), 1865, 106, iii, 19.

—— **jeffreysii**, Williamson. Recent British Foram. 1858, 34, iii, 72 and 73 [= *Haplophrag. canariensis*, d'Orb.].

—— —— —— Terquem, Ess. Anim. Plage Dunkerque, (2), 1876, 71, vii, 22 (and Mém. Soc. Dunkerquoise).

—— —— —— var. *Ibid.* (3), 1881, 118, xiii, 25 (and Mém. Soc. Dunkerquoise).

—— [**jeffreysii**] —— Schlumberger, F. Jeun. Nat., Feb., 1882, ii, 6 and 7.

—— **koldeweyi**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 286.

—— —— —— Ehr., in Koldewey, Zweite Deutsche Nordpolarfahrt, 1874, ii, n. d., i, 6.

—— **labradorica**, Dawson. Canad. Nat. V, 1860, 191, f. 4 [see *N. scapha*].

—— —— —— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., ii, 44 and 45.

—— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 293, No. 3.

—— —— —— Guérin-Menéville's Cuvier Iconographie, Mollusques, 1829–43, 9, ii, 7.

—— —— —— Cuvier, Animal Kingdom, Henderson's ed., III, 1834 (pls. 1837), 17, iii, 7.

—— **lævis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 11.

—— —— —— D'Orbigny, Modèles, No. 46, 1826.

—— —— —— P., J. & B. [d'O., Modèles 46], Ann. Mag. Nat. Hist. [3], XVI, 1865, 26, iii, 97 [= *N. incrassata*, F. & M.].

—— —— —— Terquem, Mém. Soc. Géol. France, [3], II, 1882, 44, ii (x), 12–14.

NONIONINA lævis, d'Orbigny. Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.
——— **lamarckii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 13.
——— **latescens**, Schwager. Palæontographica, XXX, 1883, Pal. Theil, 137, xxvi (3), 4*a*–*c*.
——— **latidorsata**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 339, xvi, 4 [v. *Haplophragmium*].
——— **leo**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, (1), 1868, 190, v, 8.
——— **limba**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 294, No. 14.
——— ——— ——— D'Orb., Modèles, No. 11, 1826.
——— ——— ——— P., J. & B. [d'O., Modèles 11], Ann. Mag. Nat. Hist. [3], XVI, 1865, 20, iii, 99.
——— ——— ——— Basset, Ann. Soc Sci. Charente-Inf. 1884 (85), 163, fig.
——— **macromphalus**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 232, iv, 4*a*, *b*.
——— **magdeburgica**, Philippi. Palæontographica, I, 1851, 81, x*a*, 21*a* [v. also *Robulina*].
——— **melo**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 293, No. 4.
——— ——— ——— = *N. pompilioides* (F. & M.), see *Nautilus melo*.
——— **millepora**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427, iii, vii, 50.
——— **nautiloidea**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, not descr., xx, 1.
——— **neglecta**, Michelotti. Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III (2), 1847, 15, not figured.
——— **nodulosa**, Terquem. Cinquième Mém. Foram. Oolithique, 1883, 367, xli, 11*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. Géol. France, [3], IV, 1886, 47, v, 4 and 5.
——— **nympharum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 286.
——— **obliqua**, Costa. Atti Accad. Pontaniana, VII, (2), 1856, 204, xvii, 17*A*, *B*.
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—— —— —— Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 138, f. 48^{15}.

—— —— —— Hoernes, Elem. Palæont. 1884, 27, f. 16; French ed. 1886, same fig.

—— **seminulum**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 93; and Mikrogeologie, 1854, xxiii, *E*, 3 [= *Nummulites guettardi*, d'A. & H.].

—— **soldanella**, Costa. Atti Accad. Pontaniana, VII, (1), (1853), 110, ix, 9*c*.

—— **spira**, de Roissy. Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 138, f. 48^{2} [*Nummulites*, 1805].

—— **striata** (d'Orbigny), v. *Camerina* (Bruguière).

—— —— —— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 71, viii, 5 [sarcoda].

—— —— —— Carpenter, Parker & Jones, Introd. Foram. 1862, 271, xxii, 6 [cast].

—— —— —— Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 138, f. 48^{17}.

—— —— —— Carpenter, The Microscope, ed. 6, 1881, 584, f. 337 [structural].

—— **targionii**, Meneghini MS.; [an *Amphistegina*, q. v.].

—— **tchihatcheffi**, d'Arch. Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 138, f. 48^{18} [*Nummulites*, 1853].

—— **umbilicata**, Schafhäutl. Neues Jahrbuch, 1846, 418, viii, 4*a* and 5.

—— **umbo-reticulata**, Schafhäutl. *Ibid.* 1846, 416, viii, 5*a* [and 6] [= *Orbitoides*].

—— **variolaria** [Lamarck]. See *Nautilus radiatus*, F. & M.; *N. venosus*, F. & M. [*Lenticulites*, 1804].

NUMMULINA variolaria [J. de C. Sowerby]. Brady, Geol. Mag. [2], II, 1875, 533, xiii, *2a, b, c* and *3a, b, c;* and Jaarb. Mijn. Ned. Oost.-Indie, VII, (2), 1878, 159, i, *2a, b, c* and *3a, b, c* [*Nummularia*, 1829].

——— ——— ——— Jones in Dixon, Geol. of Sussex, ed. 2, 1878, 172, ix [10], 7.

——— ——— ——— Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 138, f. 48^9.

——— ——— ——— Steinmann, Elem. Paleont. I, 1888, 34, f. 21, *C, D.*

——— **wilcoxi**, Heilprin. [Heilprin], Amer. M. Micro. Journ. IV, 1883, 1, f. 1 and 2 [*Nummulites*, 1882].

——— **irregulares**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, (2), 93, iv, 47–55; v, 63, 66.

——— ? sp., Carter. Journ. Bombay Br. R. Asiatic Soc. V, (18), (1853), 132, ii, 9 and 10; and Annals and Mag. Nat. Hist. [2], XI, 1853, 169, vii, 9 and 10.

——— sp. ind., Martin, Samml. Geol. Reichs-Mus. Leiden, [1], I, (2), 1881, 109, v, 8.

——— Pictet. Traité de Paléont. IV, 1846, 225, xii, 7.

——— Carpenter, Quart. Journ. Geol. Soc. VI, 1850, 22, pls. iii to viii [minute structure].

——— Mantell, Medals Creation, ed. 2, 1854, 344, f. 110.

——— Macdonald, Annals and Mag. Nat. Hist. [2], XX, 1857, 194, vi, 32.

——— Carpenter, Parker & Jones, Introd. Foram. 1862, 262, xviii [structural].

——— see *Nummulites* in all cases.

NUMMULITA lævigata, Lam. Fleming, Hist. Brit. Anim. 1828, 233.

NUMMULITES, Lamarck, 1801. Syst. Anim. sans Vertèbres, IX, (1801), 101.

——— **acuminata**, Kutorga. Trudui mineral. Obsh. (St. Petersburg), II, (1834), (12), xv, 6.

——— **acuta** (J. de C. Sow.). Jones in Microgr. Dict. ed. 4, 1883, 549, xxiv, 22 [*Nummularia*, 1837].

——— **althausii**, Alberti. Beitr. Monogr. Bunt. Sandst. etc., 1834, 53, no fig.

——— **amygdala**, Schafhäutl. Sud.-Bayerns Lethæa Geogn. 1863, 99, ix, 4, 5 and 7.

——— **anomala**, de la Harpe. Bull. Soc. Géol. France, [3], V, 1877, 827, xvii, 12–18.

——— ——— ——— De la Harpe, Bull. Soc. Vaud. Sci. Nat. [2], XVI, 1879, 211, x, 12–18.

——— **arbiensis**, Conrad. In Lynch, Off. Report, U. S. Exped. Dead Sea, 1852, 227, xxii, 127.

——— **aspera**, Catullo. Ann. Fisica (Zantedeschi's), 1849–50, 250.

——— **aspera**, Kutorga. Trudui mineral. Obsh. (St. Petersburg), II, (1834), (10).

——— **assilinoides**, Murchison, MS. Jones, Cat. Foss. Foram. B. M. 1882, 30.

——— **atacicus**, Leymerie. Mém. Soc. Géol. France, [2], I, 1844, 358, xiii, *13a–e*.

——— [**atacica**] ——— Joly & Leymerie, Mém. Ac. Sci. Toulouse, [3], IV, 1848, 171, i, 4–8.

——— [**ataica**] ——— Emmons, Manual of Geology, ed. 2, 1860, 215, f. 183, 1, 2.

——— **aturica**, Joly & Leymerie. Mém. Ac. Sci. Toulouse, [3], IV, 1848, 171, etc., ii, 9 and 10.

——— **beaumonti**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, (1), 1853, 133, viii, *1a–e*, 2, 3.

——— ——— ——— De la Harpe, Palæontographica, XXX, 1883, Pal. Theil, 180, xxxi (2), 37–47.

——— **bellardii**, d'Archiac. In Bellardi, Mém. Soc. Géol. France, [2], IV, 1847, 273, iv [xv], 11–15.

——— ——— ——— D'Archiac, *ibid.* [2], IV, 1851, 273, iv, 11–15.

——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, (1), 1853, 113, v, *9a–f*.

——— **bericensis**, de la Harpe. Mém. Soc. paléont. Suisse, X, 1883, 162, v, 23.

——— **biaritzensis**, d'Archiac. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, (1), 1853, 131, viii, *4a–f, 5a, 6a* [v. *Nummulina*].

NUMMULITES biaritzensis, d'Archiac. Michelotti, Nat. Verh. Holland. Maat. Wet. Haarlem, [2], xv, 1861, 19, i; 10 and 11.
—— —— —— Verbeek, Neues Jahrbuch, 1871, 9, iii, *1a–f.*
—— —— —— Verbeek, Jaarb. Mijn. Ned. Oost.-Ind. 1874, II, 155, ii, 28–33.
—— —— —— De la Harpe, Bull. Soc. Borda à Dax, V, 1880, 68, f. 1.
—— **[biarizensis]** —— Abich, Geol. Forsch. Kaukas. Ländern, 1882, 246, xi, 5; ix, 3, *3a* [error]; and f. 43.
—— —— —— De la Harpe, Palæontographica, XXX, 1883, Pal. Theil, 168, XXX (1), 19–28.
—— —— —— Vutskits, Orvos termesz. Tars. Ertesitö, 1883, [65], iv, *8a, b, c.*
—— —— —— Mallada, Bol. Com. Mapa geol. Españ. XI, 1884, n. d., xxix, 13–20.
—— —— —— Jones in Newton, Quart. Journ. Geol. Soc. XLV, 1889, 332, xiv, 17.
—— **biza**, Schafhäutl. Sud-Bayerns Lethæa Geogn. 1863, 13, 97, xiii, 10.
—— **bolcensis**, Munier-Chalmas. Comptes Rendus, LXXXVI, 1878, 1313.
—— **boucheri**, de la Harpe. Bull. Soc. Borda á Dax, IV, 1879, 146, i, iv, 1–10.
—— —— —— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 179, vii, 33–59. [This is divided into var. *tenuispira*, 51; var. *incrassata*, 52–59.]
—— —— —— Vutskits, Orvos termesz. Tars. Ertesitö, 1883, [60], iii, *3a, b, c.*
—— —— —— Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 205, ii, 7, 8 and 10; and 206, f. 12.
—— **bouillei**, de la Harpe. Bull. Soc. Borda à Dax, IV, 1879, 142, i, 1 [1-3].
—— —— —— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 165, vi, 1–11 [5 and 6 are given as var. *rutimeyeri*].
—— —— —— Vutskits, Orvos termesz. Tars. Ertesitö, 1883, [62], iii, *1a, b, c* [described in descr. to plate as *N. tournoueri*, De la H.].
—— **britanica**, Hantken & Madarasz. Jegyz. az 1873, vilagtarl. kiall. Numm. 1873, 7.
—— **broachensis**, Carter. Journ. Bombay Br. R. Asiat. Soc. V, No. XX, 1857, 625, no fig.
—— —— —— Carter, Annals Mag. Nat. Hist. [3], VIII, 1861, 373, xv, 3; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 63.
—— **brongniarti**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, (1), 1853, 110, v, *1a–e*, 2, 3 and 4 [*lævigata*, var. of 1845].
—— —— —— var. **puschi**, d'Arch. De la Harpe, Bull. Soc. Vaud. Sci. Nat. [2], XVI, 1879, 203, x, 1–3 [v. *N. puschi*].
—— **budensis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 74, xii, 4; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 85, same pl. and fig.
—— —— —— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 163, v, 24–34.
—— **caillaudi**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, (1), 1853, 97, i, *8a, b, c.*
—— —— —— De la Harpe, Mém. Soc. paléont. Suisse, VII, 1881, 91, etc., ii, 16–19.
—— **carpenteri**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, (1), 1853, 97, i, *7a–d.*
—— **carteri**, d'Archiac & Haime. *Ibid.* (2), 1854, 344, no figure. The species is based on *Nummulina?* Carter, Journ. Bombay Br. R. Asiat. Soc. V, 1853, 132, ii, 9 and 10.
—— —— —— Carter, Geol. Papers Western India, 1857, 541, xxiii, 9 and 10.
—— **catillus**, Schafhäutl. Sud-Bayerns Lethæa Geogn. 1863, 94, x, *6a, b, c.*
—— **chartersi**, Meneghini. De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 149, iv, 1 and 2 [*Nummulina*, 1851].
—— **chavannesi**, de la Harpe. *Ibid.* x, 1883, not descr. vi, 22–41. [This is divided into var. *densispirata*, 29–36; var. *crassispirata*, 37–40; var. *dilatata*, 41].
—— —— —— De la Harpe, Palæontographica, XXX, 1883, Pal. Theil, 163, XXX (1), 12–18.

NUMMULITES distans [Pusch]. Zittel, Handbuch Palæont. (1), 1876, 100, f. 40[1].
—— —— —— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 213, xii, 1.
—— **dufrenoyi**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 89, i, *4a–e*.
—— **dufreynoyi**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 171, v, xi [Glauc.].
—— **elegans**, Sow. De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 175, vii, 12–33 [21–23 are given as var. *depressa*] [*Nummularia*, 1826].
—— —— —— Mallada, Bol. Com. Mapa geol. Españ. XI, 1884, n. d., xxx, 11, 12.
—— —— —— Hantken, Földt. Közl. XVI, 1886, 154 and 188, i, 4.
—— —— —— Jones, Quart. Journ. Geol. Soc. XLIII, 1887, 142, xi, 1–9.
—— —— (**N. prestwichianus**) —— Prestwich, Geology, 1888, ii, 370, f. 187 *e, f*.
—— **ellipticus**, Schafhäutl. Sud-Bayerns Lethæa Geogn. 1863, 97, xiii, *3a–d, 7a–c* [error for 4], deformed specimens xiii, *4a–c;* viii, *1a–f*.
—— **excavatus**, Schafhäutl. Sud-Bayerns Lethæa Geogn. 1863, 105, no fig.
—— **exponens**, Sowerby. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 148, x, *1a, b, 2a, 3a–d*, 4–7, *7a, 8a*, 9, *10a* [*Nummularia*, 1834].
—— —— —— Schafhäutl, Sud-Bayerns Lethæa Geogn. 1863, 91, vii, 1–4; 8 and 9; xi, *2a–k*.
—— (**Assil.**) —— —— Zittel, Handbuch Palæont. (1), 1876, 98, f. 38.
—— (**Assil.**) —— —— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 21.
—— —— —— Abich, Geol. Forsch. Kaukas. Ländern, 1882, 248, ix, 6, *6a*.
—— —— —— Mallada, Bol. Com. Mapa geol. Españ. XI, 1884, n. d., xxx, 24–30.
—— (**Assil.**) —— —— Fritel, Foss. caract. terr. sedim. tert. 1886, vii, 45 and 46.
—— **fichteli**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 296, iii, 7 [*Nummulina*, on p. 302; v. also *Nummulina*].
—— —— —— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 100, iii, *5a*.
—— —— —— De la Harpe, Bull. Soc. Borda, IV, 1879, 150, i, vi, 1–10.
—— —— —— De la Harpe, Palæontographica, XXX, 1883, Pal. Theil, 211, xxxv (6), 23–28.
—— **floridanus**, Conrad. Amer. Journ. Sci. [2], II, 1846, 399, figure [referred by Conrad to *Assilina*] [v. *Cristellaria*].
—— **floridensis**, Heilprin. Proc. Ac. Nat. Sci. Philad. 1884, (3), (1885), 321, figure.
—— **fossilis**, Quenstedt. Handbuch Petref. ed. 1, 1852, 684, lxii, 5.
—— **fraasi**, de la Harpe. Palæontographica, XXX, 1883, Pal. Theil, 161, xxx (1), 1–8.
—— **fragilis**, Risso. Hist. Nat. Europe, IV, 1826, 23.
—— **garansiana**, Joly & Leymerie. Mém. Ac. Sci. Toulouse, [3], IV, 1848, 171, etc., i, 9–12; ii, 8 [v. also *Nummulina*].
—— —— —— Carter, Annals & Mag. Nat. Hist. [2], XI, 1853, 172, vii, 19 and 20.
—— —— ? —— Carter, Journ. Bombay Br. R. Asiatic Soc. V, (18), (1853), ii, 19 and 20.
—— [**garansensis**] —— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 101, iii, *6a, 7a–g*, and II, 1854, 344.
—— [**garansensis**] —— Pictet, Traité de Paléont. 2 ed., IV, 1857, 501, cix, 20.
—— [**garensensis**] —— Carter, Geol. Papers Western India, 1857, 544, xxiii, 19 and 20.
—— [**garanensis**] —— Medlicott & Blanford, Geol. of India, 1879, 460, etc., xv, 10.
—— [**garansensis**] —— Bütschli in Bronn, Klassen, etc., Thier-Reichs, 1880, 213, xii, 7.

NUMMULITES heberti, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 147, ix, 14 *a–g*, 15*a*.
——— ——— ——— De la Harpe, Palæontographica, xxx, 1883, Pal. Theil, 178, xxxi (2), 26 and 27.
——— ——— ——— Vutskits, Orvos termesz. Tars. Ertesitö, 1883, [56], iii, 5*a*, *b*, *c*.
——— **heeri**, de la Harpe. Mém. Soc. paléont. Suisse, x, 1883, 152, iv, 9–15.
——— **heilprini**, Hantken. Földt. Közl. XVI, 1886, 154 and 188, i, 2*a*, *b*, *c*.
——— **hungarica**, Hantken & Madarasz. Jegyz. az 1873 vilagtarl. kiall. numm. 1873, 8 and 9.
——— **inflatus**, Risso. Hist. Nat. Europe, IV, 1826, 24.
——— **intermedia**, d'Archiac. Mém. Soc. Géol. France, [2], II, 1846, 199 [v. also *Nummulina*].
——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 99, iii, 3*a–d*; 4*a–f*.
——— ——— ——— Michelotti, Nat. Verh. Holland Maat. Wet. Haarlem, 2, xv, 1861, 18, i, 5–7.
——— ——— ——— De la Harpe, Bull. Soc. Borda, IV, 1879, 149, i, v, 1–7.
——— ——— ——— De la Harpe, Palæontographica, xxx, 1883, Pal. Theil, 210, xxxv (6), 15–22.
——— ——— ——— Tellini, Boll. Soc. geol. Ital. VII, 1888, 53, viii, 15, 16.
——— ——— ——— v. **bormiensis**, Tellini. *Ibid.* VII, 1888, 55, viii, 14, 17.
——— **irregularis**, Deshayes. Mém. Soc. Géol. France, [1], III, 1838, 67, v, 15 and 16. For full synonymy see de la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 154.
——— ——— ——— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 154, iv, 16–34, and v, 1, 2. [This is divided into var. *formosa*, iv, 16; var. *pratti*, iv, 33, 34; v, 1 and 2; var. *regulata*, iv, 24; var. *depressa*, iv, 21–23].
——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 138, viii, 16–19, 19*a*.
——— ——— ——— Schlumberger, Compt. Rend. Assoc. Franç. 1883 (1884), 520, f. 78 and 79.
——— **irregularis**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 296, iii, 5 [*Nummulina* on p. 302, q. v.].
——— **jurassica**, Gümbel. Neues Jahrbuch, 1872, 254, vi, 1–9.
——— **kelatensis**, Carter. Annals Mag. Nat. Hist. [3], VIII, 1861, 376, xv, 6; Journ. Bombay, Branch R. Asiatic Soc. VI, 1861 (1862), 66.
——— **kochi**, Vutskits. Orvos termesz. Tars. Ertesitö, 1883, [49], iii, 4*a*, *b*, *c*.
——— **kovacsiensis**, Hantken & Madarasz. Jegyg. az 1873 vilagtarl. kiall. numm. 1873, 11.
——— **laceratus**, Quenstedt. Handbuch Petref. ed. 3, (5), (1885), 1055, lxxxvi, 38.
——— **lævigata**, Lamarck. Syst. Anim. s. Vert. 1801, 101, and Ann. Mus. V, 1804, 241, No. 1, and f. 10*a*, *b*, pl. 62, VIII, 1806 [v. also *Nummulina* and *Camerina*].
——— ——— ——— Parkinson, Organ. Rem. former World, III, 1811, 152, x, 13–16, 18 and 19.
——— ——— ——— Lamarck, Coq. Foss. Paris, 1823, 14, xiv, 10*a*, *b*.
——— ——— ——— Bronn, Syst. urweltl. Conchyl. 1824, 7, i, 10*a*, *b*.
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls., 1827), 372, iv, 2.
——— ——— ——— Deshayes, Descr. Coq. Charact. 1831, 251, iii, 11 and 12.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed., III, 1834 (pls., 1837), 17, viii, 9.
——— ——— ——— Pilla, Distinz. terr. Etrurio, 1846, 105, i, 20 [17–20].
——— ——— ——— Joly & Leymerie, Mém. Ac. Sci. Toulouse, [3], IV, 1848, 182, etc., ii, 5 and 6.
——— **lævigata** [Sow.]. Brown, Illustr. Fossil Conch. Great Britain, 1849, 37, xxvi, 5–7 [error for [6-9 ?].
——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 103, iv, 1*a–g*, 2*a*, 3, 4*a*, 5*a*, *b*, 6 and 7.
——— ——— ——— Pictet, Traité de Paléont. ed. 2, IV, 1857, 502, cix, 21.
——— **[lævigatus]** ——— Zittel, Handbuch Palæont. (1), 1876, 99, f. 392*a*, *b*.

NUMMULITES (cfr.) [**lucasanus**], Defr. Zittel, Handbuch Palæont. Abth. I, 1876, 65, f. "3;" 97, f. 37 and 40 [structural].
——— ——— ——— Lartet, Explor. Géol. Mer Morte [1877], [157], xii, 32.
——— ——— ——— var. **granulata**, de la Harpe. Bull. Soc. géol. France, [3], v, 1877, 823, xvii, *7a–b*.
——— ——— ——— var. **mentonensis**, de la Harpe. *Ibid.* [3], v, 1877, 823, xvii, *6a–c*.
——— ——— ——— var. **obsoleta**, de la Harpe. *Ibid.* [3], v, 1877, 823, xvii, *8a, b*.
——— ——— ——— Hantken, Kohlenflötze, etc. ungar. Krone, 1878 (transl. from Magyar), 219, f. 34.
——— ——— ——— var. **granulata**, de la Harpe. Bull. Soc. Vaud. Sci. Nat. [2], XVI, 1879, 205, x, *7a, b*.
——— ——— ——— var. **mentonensis**, de la Harpe. *Ibid.* [2], XVI, 1879, 206, x, *6a–c*.
——— ——— ——— var. **obsoleta**, de la Harpe. *Ibid.* [2], XVI, 1879, 205, x, *8a, b*.
——— [**lucasanus**?] ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 213, xii, 6.
——— [**lucasiana**] ——— Abich, Geol. Forsch. Kaukas. Ländern, 1882, 245, xi, 6, *6a*.
——— ——— **obsoleta**, de la Harpe. Palæontographica, XXX, 1883, Pal. Theil, 208, xxxv (6), 11–14.
——— ——— ——— Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxviii, 14–19.
——— ——— ——— Gümbel, Geol. Bayern, Th. 1, Lief. II, 1885, f. 266, 27.
——— **lyelli**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 95, ii, *9a–c*; *10a–b*; iii, *1a, b*, 2.
——— ——— ——— Pictet, Traité de Paléont. ed. 2, IV, 1857, 502, cix, 22.
——— ——— ——— Schafhäutl, Süd-Bayerns Lethæa Geogn. 1863, 104, xiii, *2a, b*.
——— ——— ——— Lartet, Ann. Sci. Géol. III, 1872, Art. 5, 89, ix, 23 and 24.
——— ——— ——— Lartet, Bibl. Ecole Haute Etudes, VII, 1873, No. 2, 89, ix, 23 and 24.
——— ——— ——— Lartet, Explor. Géol. Mer Morte [1877], [157], xii, 33.
——— ——— ——— De la Harpe, Mém. Soc. paléont. Suisse, VII, 1881, 91, etc., ii. 5–11.
——— **madaraszi**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 75, xvi, *7a, b, c*; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 86, same pl. and fig.
——— **makullænsis**, Carter. Annals Mag. Nat. Hist. [3], VIII, 1861, 375, xv, 4; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 66.
——— **mamma**, Kutorga. Trudye mineral Obshtsch. (St. Petersburg), II, (1834), (11), xv, 4.
——— **mammilla** (F. & M.). Lamarck, Ency. Method. "Vers," III, (1832), 638, (pls., 1827), 471, 2 (P. & J. quote "pt. 23," 1816). [*Nautilus*, 1798.]
——— ——— [Lam.]. Bronn, Syst. urweltl. Conchyl. 1824, 7, i, *16a, b*.
——— **mammillata**, d'Archiac. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, (I), 1853, 154, xi, *6a, b, c, 7a, b, 8a–e*. [*Nummulina*, 1847.]
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 213, xii, 5.
——— ——— ——— Vutskits, Orvos termesz. tars. Ertesitö, 1883, [69], iv, *10a, b, c*, and *11a, b, c*.
——— [**mammillatus**] ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1055, lxxxvi, 37.
——— **mantelli**, Morton. Amer. Journ. Sci. XXIII, 1833, 291, v. 9. [v. *Hymenocyclus*; *Orbitoides*; and *Orbitolites*.]
——— ——— ——— Morton, Synopsis Org. Rem. Cretac. Group, 1834, 45, v, 9.
——— ——— ——— Lyell, Quart. Journ. Geol. Soc. IV, 1848, 11.

NUMMULITES orbicularis, Kutorga. Trudye Mineral Obshtsch. (St. Petersburg), II, (1834), (9), xv, 3.

——— **orbiculatus**, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, 101, v, 11 ; vi, 3 ; vii, 5 ; xii, 4*a–f* ; xiii, 1st fig. left, without number, and *f* and *g*.

——— **orbignyi** (Galeoti). De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 168, vi, 42–51. [*Operculina*, 1837.]

——— **orsinii**, Meneghini (MS., apparently described for first time here). De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 161, v, 22.

——— **papyracea**, Boubée. Bull. Soc. Géol. France, II, 1832, p. 445, no fig. [v. *Hymenocyclus* & *Orbitoides*.]

——— **parabolicus**, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, 91, vii, 6.

——— **patellaris**, Brunner. Mitth. nat. Ges. Bern, 1848, p. 16, no fig.

——— **partschi**, de la Harpe. Bull. Soc. Vaud. Sci. Nat. [2], XVII, 1880, 37, iii, I, 1–17.

——— **pengaronensis**, Verbeek. Neues Jahrbuch, 1871, 3, i, 1*a–k*.

——— ——— ——— Verbeek, Jaarb. Mijn. Ned. Oost-Ind. 1874, vol. 2, 145, ii, 1–9.

——— **perforata** (Montfort). See *Egeon*, 1808.

——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 296, No. 7.

——— ——— [d'Orbigny]. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 115, vi, 1*a–g*, 2, 3, 4, 5*a*, 6*a*, 7*a*, 8*a*, 9*a*, *b*, 10*a*, *b*, *c*, 11*a*, 12 [with varr. and subvarr.]

——— ——— [d'Orb.] v. A, **aturensis**, d'Archiac & Haime. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 120, vi, 5–8 [with subvarr.]

——— ——— [d'Orb.] v. B, **columbresensis**, d'Archiac & Haime. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 120, vi, 9 and 10 [with subvarr.]

——— ——— [d'Orb.] v. C, d'Archiac & Haime. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 119, vi, 11 and 12.

——— ——— [d'Arch.]. Abich, Mém. Ac. Imp. Sci. [Math. Phys.] St. Pétersbourg, [6], VII, 1859, 528, iii, 12*a*, *b*.

——— ——— [d'Orb.]. Michelotti, Nat. Verh. Holland. Maat. Wet. Haarlem, 2, xv, 1861, 18, i, 3 and 4.

——— ——— [d'Orb.]. D'Archiac, in Tchihatcheff, Asie Mineure, Palæontologie, 1866, 206, ix, 4*a*, s.-var. ζ.

——— ——— [d'Orb.]. Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 134, ii, 3, 3*a* ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 141, same pl. & fig.

——— ——— [d'Orb.] var. **umbonata**, de la Harpe. Bull. Soc. géol. France, [3], V, 1877, 822, xvii, 4*a*, *b* ; and Bull. Soc. Vaud. Sci. Nat. [2], XVI, 1879, 205, x, 4*a*, *b*.

——— ——— [d'Orb.]. Hantken, Kohlenflötze, etc. ungar Krone, 1878, (transl. from Magyar), 219, fig. 33.

——— ——— [d'Orb.]. De la Harpe, Mém. Soc. paléont. Suisse, VII, 1881, 34, fig. 2.

——— ——— [d'Orb.]. Abich, Geol. Forsch. Kaukas. Ländern, 1882, 247, ix, 7 ; xi, 9.

——— ——— [d'Orb.]. De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, pl. iii. 1–6. This is divided into v. *uranensis*, iii, 1–3 ; v. *obesa*, iii, 4 ; v. *umbonata*, iii, 5 ; v. *subglobosa*, iii, 6.

——— ——— [d'Orb.]. Mallada, Boll. Com. Mapa Geol. Españ. XI, 1884, n. d. xxix, 1–12.

——— ——— [d'Orb.]. Fritel, Foss. Caract. terr. sedim. tert. 1886, pl. vii, 43 and 44.

——— **perforata-obesa**, Leym. De la Harpe, Palaeontographica, XXX, 1883, Pal. Theil, 206, xxxv (6), 1–10.

NUMMULITES ramondi, Defrance. Medlicott & Blanford, Geol. of India, 1879, 458, xv, 12.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 213, xii, 3.
——— ——— ——— De la Harpe, Palaeontographica, xxx, 1883, Pal. Theil, 173, xxxi (2), 5–12.
——— ——— ——— Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxviii, 20–25.
——— **renevieri**, de la Harpe. Mém. Soc. paléont. Suisse, x, 1883, pl. iii, 8–14.
——— **reticulatus**, Schafhäutl. Süd-Bayerns Lethaea Geogn., 1863, 98, v, 6; vii, 7*a–e* and 10; ix, 1, 2, and 6; x, 1, 2; xiv, 2.
——— ——— ——— Haeckel, Das Protistenreich, 1878, 33, fig. 18*a–f*.
——— **reticulatus**, Tellini. Boll. Soc. geol. Ital. VII, 1888, 60, viii, 13.
——— **rosai**, Tellini. Boll. Soc. geol. Ital. VII, 1888, 22, viii, 1–3.
——— **rota**, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, 92, x, 4*a–e*.
——— **rotula**, Grateloupe, MS. D'Orbigny, Prodrome de Paléont., II, 1850, 336, No. 681.
——— **rotularius**, Deshayes. Mém. Soc. géol. France, [1], III, 1838, vi, 10, 11. [v. also *Nummulina*.]
——— **rouaulti**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 121, vi, 14*a–d*.
——— ——— ——— Figuier, Ocean World, London, [1873], p. 81, f. 12.
——— **rovasendai**, Tellini. Boll. Soc. geol. Ital. VII, 1888, 25, viii, 6.
——— **rutimeyeri**, d'Archiac. In Tchihatcheff, Asie Mineure, Palæontologie, 1866, 212, ix, 5*a*, *b*, *c*.
——— **rutimeyeri**, de la Harpe. Palaeontographica, xxx, 1883, 162, xxx (1), 9–11.
——— **saccoi**, Tellini. Boll. Soc. geol. Ital. VII, 1888, 49, viii, 12.
——— **scabra**, Lamarck. Ann. Mus. v, 1804, p 2. 41, No. 3; Hist. Anim. s. Vert. VII, 1822, p. 629, and ed. 2, XI, 1845, p. 306.
——— ——— ——— Kutorga, Trudye mineral Obshtsch. (St. Petersburg), II, (1834), [10], xv, 5.
——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 107, iv, 9*a–d*, 10*a*, 11*a*, 12*a*.
——— ——— ——— Carter, Geol. Papers Western India, 1857, 543, xxiii, 21 and 22.
——— [**scaber**] ——— Schafhäutl, Süd-Bayerns Lethaea Geogn. 1863, n. d. xii, 2.
——— ——— ——— Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxviii, 5–10.
——— ——— ——— Quenstedt, Handbuch Petref. Abth. v, 1885, 1054, fig. 394.
——— **semicostata** (Kaufm.). Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 267, fig. 13; ii, 9, 11–13. [*Amphistegina*, 1867.]
——— **sigillum**, Kutorga. Trudye mineral Obshtsch. (St. Petersburg), II, (1834), [11], xv, 2.
——— **sinuosus**, Risso. Hist. Nat. Europe, IV, 1826, 24.
——— **sismondai**, d'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 124, vii, 4*a–d*.
——— ——— ——— var. **subglobosa**. De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, pl. iii, 7.
——— **solitaria**, De la Harpe. Palaeontographica, xxx, 1883, 176; xxxi (2), 18 and 19.
——— **spira**, de Roissy. Hist. Nat. de Mollusques (Sonnini's Buffon), v, 1805, p. 57. [v. also *Nummulina*.]
——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 155, xi, 1*a*, *b*, *c*, 2*a*, 3*a*, 4*a*, *b*, 5.
——— ——— ——— Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxx, 36–38.

* Hantken's quotation is *incorrect*. I have not been able to trace d'Orbigny's original reference.

NUMMULITES tchihatcheffi, d'Archiac. Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 204, fig. 11.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 133, ii, 2a, b, c, d; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 140, same pl. and fig.

——— ——— ——— Hantken, Kohlenflötze, etc. ungar. Krone, 1878 (transl. from Magyar), 226, fig. 41.

——— ——— ——— Vutskits, Orvos termesz. tars. Ertesitö, 1883 [42], iv, 12a, b, c.

——— **teruncius**, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, 93, v, 3a; x, 3; xiv, 2 links.

——— **tournoueri**, de la Harpe. Bull. Soc. Borda à Dax, IV, 1879, 143, i, ii, 1–7.

——— ——— ——— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 166, vi, 12–21. [18 and 19 are given as v. *laxispira*.]

——— ——— ——— Vutskits, Orvos termesz. tars. Ertesitö, 1883 [62], iii, 1a, b, c. [Described as *N. bouillei*, De la Harpe, in text.]

——— ——— ——— Hantken, Földt. Közl. XVI, 1886, 154 and 188, i, 3.

——— ———? ——— Tellini, Boll. Soc. geol. Ital. VII, 1888, 42, viii, 8 and 9.

——— **variabilis**, Tellini. Boll. Soc. geol. Ital. VII, 1888, 38, viii, 7.

——— **variolaria** [Lamarck], [d'Orb.], 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 427, no. 1673. [*Lenticulites*, 1804.]

——— ——— [Sowerby *]. Brown, Illustr. Fossil. Conch. Great Britain, 1849, 37, xxvi, 3–5. [& ? 10 and 11.] [*Nummulina*, 1820.]

——— ——— [Sow.]. D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 146, ix, 13a–g.

——— ——— [Sow.], var. **prima**, Fraas. Württemberg nat. Jahresh. 1867, p. 226, no fig.

——— ——— [Sow.], var. **minor**, de la Harpe. Bull. Soc. géol. France, [3], v, 1877, 825, xvii, 11a–d.

——— ——— [Sow.], var. **minima**, de la Harpe. Bull. Soc. Vaud. Sci. Nat. [2], XVI, 1879, 210, x, 11a–d.

——— ——— De la Harpe, Palaeontographica, XXX, 1883, Pal. Theil, 179, xxxi, (2), 28 and 29.

——— ——— [Sow.]. Vutskits, Orvos termesz. tars. Ertesitö, 1883, [56], iii, 6a, b, c.

——— ——— [Sow.]. Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxx, 19–23.

——— ——— [Sow.]. Fritel, Foss. caract. terr. sedim. tert. 1886, pl. vii, 50–52.

——— ——— ——— Jones, Quart. Journ. Geol. Soc. XLIII, 1887, 145, xi, 10–14.

——— ——— ——— Prestwich, Geology, 1888, ii, 370, fig. 187g, h.

——— **vasca**, Joly & Leymerie. Mém. Ac. Sci. Toulouse, [3], IV, 1848, 171, etc. i, 15–18; ii, 7.

——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 145, ix, 11a–d, 12.

——— ——— ——— De la Harpe, Bull. Soc. Borda à Dax, IV, 1879, 145, i, iii, 1–3.

——— ——— ——— De la Harpe, Mém. Soc. paléont. Suisse, x, 1883, 177, vii, 24–32 [v. *incrassata*, 27 and 28; v. *tenuispina*, 29–32].

——— **verneuili**, D'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 123, vii, 1a–d, 2, 3.

——— ——— ——— Mallada, Bol. Com. Mapa Geol. Españ. XI, 1884, n. d. xxix, 21–24.

——— **vicaryi**, D'Archiac & Haime. Descr. Anim. groupe nummulitique Inde, I, 1853, 139, ix, 1a, b, c.

——— **vicensaensis**, Hantkin & Madarasz. Jegyz. az 1873 vilagtarl. Kiall. Numm. 1873, p. 5.

* Lamarck's species, *Lenticulites variolaria*, is given as the synonym.

NUMULITES denarius, Montfort. Conch. syst. I, 1808, 155, 39th genre. [= *Nummulina laevigata.*]
NUMULLINA, Amer. M. Micro. Journ. 1883, misprint for *Nummulina.*
NUMULUS luteus vulgaris exiguus est Lapis orbiculubatus, ad Collem Cockerley-Hill dictum in Comitatu Glocestriæ, vulgatissimus. Luid., Lithoph. Brit. Ichnogr. 1699 (ed. 2, 1760), p. 90, no fig.
Nuovo genere ? Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr. xvii, 19, = *Crist. rotulata ;* xxii, 9 = *Polymorph. ;* xxii, 12, = ? a *Foram. ;* xxiii, 3, = ? *Lingulina ;* xxiii, 18, = *Textularia.*
OBLIQUINA, Seguenza.
——— **acuticostata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 75, ii, 65–67. [v. *Lagena oviformis*, Sherborn & Chapman ; Referred to *Chilostomella*, 1889.]
OCULINA, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, p. 11.
——— **carinata**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 14, ii, 19.
——— **cretacea**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 19, iii, 20. [= *Miliolina.*]
——— **liasica**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 11, i, 24. [= a *Miliolina.*]
——— **nucleus**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 14, ii, 20.
——— **porosa**, Kübler & Zwingli. Neujahrsblatt Burgersbibl. Winterthur, 1866, 12, ii, 6. [= *Miliolina.*]
"**Œufs d'autres mollusques.**" Cornuel, Mem. Soc. géol. France, [2], III, 1848, 259 ; ii, 36 and 37. [= *Placopsilina* and *Webbina*, q. v.]
"**Œufs de mollusques.**" Cornuel. [v. *Placopsilina cornueliana*, d'Orb.]
OLIGOSTEGINA lævigata, Kaufmann. In Heer, Urwelt Schweiz, 1865, 197, fig. 108 ; transl. London, 1876, 206, fig. 108. ["Early chambers of *Planorbulina* or *Textularia*," T. R. Jones.]
OMPHALOCYCLUS, Bronn, 1851–52. Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, p. 95.
——— **macroporus** (Lam.). Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 95, xxix, 9*a*, *b*, *c*. [*Orbulites*, 1816.]
OMPHALOPHACUS hemprichii, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 132.
——— ? **tenellus**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 34. [= *Pulvin. menardii*, d'O.]
ONCOBOTRYS, Ehrenberg, 1855. Abhandl. k. Ak. Wiss. Berlin, 1855, 161. [*Glauc.*]
——— **buccinum**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 161, ii, vi. [= ? *Polymorphina* vel *Bulimina.*] [Glauc.]
OOLINA, d'Orbigny, 1839. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," p. 18.
——— **acicularis**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 586, i, 3*a–c*. [v. also *Lagena.*]
——— **apiculata**, Reuss. Haidingers Naturw. Abh. IV, Abth. I, 1851, 22, i, 1. [v. also *Lagena* and *Fissurina.*]
——— **caudata**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 19, v. 6. [v. also *Lagena.*]
——— **clavata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 24, i, 2 and 3. [v. also *Lagena.*]
——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 242, xxxv ? 2, 5*a*, *b*.
——— ——— ——— Pictet, Traité Paléont. 2d ed. IV, 1857, 483, cix, 2.
——— **compressa**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 18, v, 1 and 2. [= *Lagena marginata*, W. & B.]
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 23, xxi, 1 and 2.

OPERCULINA angigyra, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 370, xlvi, 19.

——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1052, lxxxvi, 21.

——— **arabica**, Carter. Annals and Mag. Nat. Hist. [2], x, 1852, 161, iv, 1–9. [v. also *Orbitolites.*]

——— ——— ——— Carter, Journ. Bombay Br. R. Asiat. Soc. IV, 1853, 430, plate.

——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 555, xxiv, 23–26.

——— ——— ——— See *Orbitolites.*

——— **biconcava**, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, 105, xiv, 4*a*, *b*, and *d*.

——— **boissyi**, d'Archiac. Mém. Soc. géol. France, [2], III, 1848, 417, ix, 26.

——— ——— ——— Schauroth, Sitz. k. Ak. Wiss. Wien, XVII, 1855, 545, iii, 7.

——— **canalifera**, d'Archiac. Hist. Prog. Géol. III, 1850, p. 245.

——— ——— ——— D'Archiac & Haime, Descr. Anim. groupe nummulitique Inde, I, 1853, 182, xii, 1*a*, *b*, *c*; and II, 1854, 346, xxxv, 5*a* ; xxxvi, 15*a*, 16*a*.

——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 664, ii, 112.

——— (cf.) ——— ——— Schwager, Palaeontographica, xxx, 1883, Pal. Theil, 144, xxix (6), 3*a*, *b*.

——— **carinata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 209, xvii, 1, A, B [error for 15]. [v. *Cornuspira.*]

——— **complanata** (Defrance). Quoted as Basterot's by d'Orbigny in error. [*Lenticulites*, 1822.]

——— ——— [Basterot]. D'Orbigny, Ann. Sci. Nat. VII, 1826, 281, No. 1, xiv, [iv in text, by error], 7–10.

——— ——— ——— D'Orbigny, Modèles, No. 80, 1826.

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 285, ii, 1.

——— ——— [d'Orb.]. Reuss, in Geinitz, Grundr. Verstein. 1845–46, 665, xxiv, 41.

——— ——— ——— Rütimeyer, Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, iv, 56.

——— ——— [Bast.]. Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 208, xxxv², 7*a*–*d*.

——— ——— ——— T. Wright, Ann. Mag. Nat. Hist. 2, xv, 1855, 75, vii, 4*a*, *b*.

——— ——— [Bast.]. Parker & Jones, Ann. Mag. Nat. Hist. 2, XIX, 1857, 285, xi, 3 and 4.

——— ——— [d'Orb.]. Michelotti, Nat. Verh. Holland. Maat. Wet. Haarlem, 2, xv, 1861, 20, i, 14 and 15.

——— ——— ——— P. J. & B. [d'O., Modèles, 80], Ann. Mag. Nat. Hist. [3], XVI, 1865, 32, iii, 93.

——— ——— [Bast.]. Zittel, Handbuch Palaeont. Abth. I, 1876, 96, fig. 36.

——— ——— [Bast.]. Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 25, pl. 22.

——— ——— [d'Orb.]. Locard, Ann. Soc. Agric. Hist. Nat. Lyon, 4, IX, 1877, 231, vi [error for v], 6 and 7.

——— ——— ——— Brady, Report Challenger, 1884, 743, cxii, 3, 4, 5, and 8.

——— ——— ——— v. **granulosa**, Leymerie. Brady, Report Challenger, 1884, 743, cxii, 6, 7, 9, and 10. [v. *Operc. granulosa.*]

——— ——— [Bast.]. Basset, Ann. Soc. Sci. Charente-Inf., 1884 (1885), 162, fig.

——— ——— ——— Woodward & Thomas, 13 Ann. Rep. Geol. N. H. Survey Minnesota for 1884 (1885), 175, iv, 35.

——— ——— ——— v. **granulosa**, Leym. Woodward & Thomas, 13 Ann. Rept. Geol. N. H. Survey Minnesota for 1884 (1885), 164, ii [error for iv], 36.

OPERCULINA irregularis, Reuss. Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 10, i, 17.

——— **libyca**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 142, xxix (6), 2*a–g*. (Type is *O. ammonea*, Leym.)

——— **madagascariensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, p. 281, No. 4.

——— **marginata**, Kaufmann. Beitr. geol. Karte Schweiz, V, 1867, 152, ix, 4.

——— **murchisoni**, Brunner, MS. Jones, Cat. Foss. Foram. Brit. Mus. 1882, 31.

——— **orbignii**, Galeotti. Mém. Couronnés Acad. R. Bruxelles, XII, 1837, Mém. iii, 141, iii, 13.

——— [——— ———] (fide Nyst). Potiez et Michaud, Galerie des Mollusques Mus. Douai, Paris, I, 1838, 34, x, 1 and 2.

——— **perforata**, Costa. Atti Accad. Pontaniana, VII, 2, 1856, 210, xvii, 4, *A*, *B*. [Error for 14.]

——— **plicata**, Czjzek. Haidinger's Nat. Abh. II, 1848, 146, xiii, 12 and 13. [= *Cornuspira foliacea*.]

——— ——— ——— Pictet, Traité de Paléont. 2 ed. IV, 1857, 504, cix, 23.

——— **punctata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 370, xlvi, 21.

——— **pyramidum**, Ehrenberg. Schwager, Palaeontographica, XXX, 1883, Pal. Theil, 143, xxix (6), 4*a–g*. [*Planulina pyramidum*, Ehrenberg, Abk. k. Wiss. Berlin, 1803, p. 115.] [? pl. iv, 7.]

——— **rosacea**, Kaufmann. Beitr. geol. Karte Schweiz, V, 1867, 153, ix, 5.

——— **rotella** (Conrad). Heilprin, Journ. Ac. Nat. Sci. Philad. [2], ix, 137, no fig. ["The species is not impossibly identical with *O. complanata*," A. H.] [v. *Cristellaria*.]

——— **semistriata**, Schauroth. Sitz. k. Ak. Wiss. Wien, XVII, 1855, 545, iii, 9.

——— **simplex**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 46, ii (x), 23*a*, *b*.

——— **striata**, Czjzek. Haidinger's Nat. Abh. II, 1848, 146, xiii, 10 and 11. [= *Cornuspira foliacea*.]

——— **studeri**, Kaufmann. Beitr. geol. Karte Schweiz, V, 1867, 151, ix, 1 and 2.

——— **sublævis**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 665, ii, 113*a*, *b*, *c*.

——— **sulcata**, Kaufmann. Beitr. geol. Karte Schweiz, V, 1867, 152, ix, 3.

——— **tattaensis**, d'Archiac & Haime. Descr. Anim. Foss. groupe nummulitique Inde, ii, 1854, 347, no figure, based on *Operculina* ———?, Carter, Journ. Bombay Br. R. Asiat. Soc. V, 1853, 131, ii, 3 and 4.

——— ——— ——— Carter, Geol. Papers Western India, 1857, 539, xxiii, 3 and 4.

——— **taurinensis**, Michelotti. Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, II verzam. 3 dl. 2 stk. 1847, 17, i, 4. [*taurina* in plate.]

——— **thouini**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 281, No. 3.

——— **thracensis**, d'Archiac. In Tchihatcheff's Asie Mineure, Palaeontologie, 1866, 224, ix, 6*a*, *b*.

——— Lyell, Elem. Geol. 1838, 55, fig. 21. [= *Crist. cultrata*.]

——— Ansted, Geology, 1844, ii, 63, fig. f.

——— Pictet, Traité de Paléont. IV, 1846, 229, xii, 10. [= *Cornuspira*.]

——— Pilla, Trattato di geol. pt. I, 1847, 461, fig. 80. [= *Cristellaria*.]

——— ? sp. Carter, Journ. Bombay Br. R. Asiatic Soc. V, pt. XVIII (1853), 131, ii, 3 and 4. [See *O. tattaensis*.]

——— Macdonald, Ann. Mag. Nat. Hist. [2], XX, 1857, 193, vi, 31 and 33. [= *Calc. spengleri*.]

——— Carpenter, Phil. Trans. 1859, 12, pls. iii, iv, v, vi, and woodcuts in text iv, v, vi, vii, viii.

——— Carpenter, Parker & Jones, Introd. Foram. 1862, 57, fig. ix ; 58, fig. x ; 247, pl. xvii ; figs. xxxix–xliv in text. [Structure.]

OPERCULINA sp. (after Carpenter). Reuss' Models, No. 100, 1865. (Catal. No. 98, 1861.)

——— Kölliker, Icones Histiologicae, 1864, 31. [Structural.]

——— Williamson, Pop. Sci. Rev. IV, 1865, 173, viii, 14. [Section of shell-wall showing pseudopodial tubes.]

——— Figuier, Ocean World [1873], p. 84, fig. 19.

——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 381, fig. 22. [Structure.]

——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 212, x, 4.

OPERCULUM minimum Littoris Arimenensis durissimum depressum, Cornu Hammonis quodammodo referens. Plancus, De Conch. Min. 1739, also 1760, p. 18, pl. iii, *A, B, C* ; and pl. iii, f. 2 *E, D, C.* [= ? *Biloculina.*]

——— see *Umbilicum.*

OPHIDIONELLA, De Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 1881, p. 140, n. d. 1 sp. proposed.

OPHTHALMIDIUM, Zwingli & Kübler, 1870. Foram. Schweiz. Jura, 1870, p. 46, etc. ; Brady, Report Challenger, 1884, p. 188.

——— **auris**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 31, III, 49. [= *Quinquelocuilna.*]

——— **birmenstorfensis**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 31, iii, 46. [= *Spiroloculina.*]

——— **carinatum**, Balkwill & Wright. Trans. R. Irish Ac. XXVIII (Sci.), 1885, 326, xii, 13–16.

——— ——— Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 22, ii, Ornatenthon, 6 ; 16, ii, Blagdeni-schichten, 11 and 12.

——— ——— ——— Haeusler, Neues Jahrb. 1887, i, 194, vii, 39, 40, 43–45, 47–51.

——— **cornuspiroides**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 31, iii, 50.

——— **gracile**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 31, iii, 47.

——— **inconstans**, Brady. Report Challenger, 1884, 189, xii, 5, 7 and 8. [*Hauerina*, 1879.]

——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 216, xl, 12, 13.

——— **liasicum**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, ii, i, Jurensismergel, ii.

——— **medium**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 31, iii, 48.

——— **multiplex**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 22, ii, Ornatenthon, 7.

——— **nubeculariformis**, Haeusler. Neues Jahrb. 1887, i, 193, vii, 52, 53, 55, and 56.

——— **okeni**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 18, ii, Parkinsonthon, 10, 11.

——— **orbiculare**, Burbach. Zeitschr. naturw. Halle, LIX, 1886, 499, v, 3–6.

——— **ovale**, Burbach. Zeitschr. naturw. Halle, LIX, 1886, 499, v, 7–12.

——— **porosum**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 14, ii, Opalinusthon, 7.

——— **superbum**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 47 iv, Anhang 5. [= *Quinqueloculina.*]

——— **tongricum**, Zwingli & Kübler. Foraminif. Schweiz. Jura, 1870, 47, iv, Anhang 3, 4. [= *Spiroloculina.*]

——— **tumidulum**, Brady. Report Challenger, 1884, 189, xii, 6.

——— **walfordi**, Haeusler. Neues Jahrb. 1887, i, 192, vi, 7–11.

——— Wallich, North Atlantic Sea-bed, pt. I, 1862, n. d. v, 13.

——— Haeusler, Neues Jahrb. 1887, i, 190, vi and vii.

——— Neumayr, Stämme d. Thierreiches, I, 1889 (1888), 177, fig. 19.

ORBICULA depressa, Reeve. Conch. System. II, 1842, 289, ccxcvii, 3. [*Heterostegina depressa*, d'O. = *Heterosteg.*]

ORBICULINA, Lamarck, 1816. Ency. Méthod., "Vers," III (1832), 669 (P. & J. quote pt. 23, 1816); Brady, Report Challenger, 1884, p. 208.

—— **adunca** (Fichtel & Moll). Lamarck, Ency. Méthod., "Vers," III (1832), 669 (pls. 1827) (P. & J. quote pt. 23, 1816), 468, f. 2. [*Nautilus*, 1798.]

—— —— [Lam.]. D'Orbigny, in De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 64, viii, 8–16; also in Spanish, 1840, p. 81, same pl. & fig.

—— —— —— Williamson, Trans. R. Micr. Soc. III, 1849, 115, xviii, 15–18. [Structure.]

—— —— —— Carpenter, Phil. Trans. 1856, 547–552, xxviii, 1–22 (17 = *Orbitolites malabaricus*, Carter); xxix, 1–3.

—— —— —— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 71, vii, 2 *A–E*. [Structural.]

—— —— —— Carpenter, Parker & Jones, Introd. Foram. 1862, 93, viii, 1–12. [Structural.]

—— —— —— Kölliker, Icones Histiologicae, 1864, 31. [Structural.]

—— —— —— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 20, iii, 44.

—— —— [d'Orb.]. Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 27, pl., 110.

—— —— —— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 118, ix, 304–307.

—— —— —— Jones, in Microgr. Dict. ed. 4, 1883, 557, xxiii, 19.

—— —— —— Brady, Report Challenger, 1884, 209, xiv, 1–13.

—— —— —— Agassiz, Three Cruises "Blake," II, 1888, 160, fig. 486, 487.

—— —— —— See *Archias; Helenis;* and *Ilotes*.

—— **angulata**, Lamarck. Hist. Anim. s. Vert. VII, 1822, p. 609, No. 2.

—— —— —— Ency. Méthod., "Vers," III (1832), 669 (pls. 1827), (P. & J. quote pt. 23, 1816), 468, f. 3.

—— —— —— Brown, Elem. Foss. Conch. 1843, n. d. iii, 5 and 6.

—— **(Orbitolites) complanata** (Lam.). Williamson, Trans. R. Micr. Soc. III, 1849, 115, xvii, 8; xviii, 9–14. [*Orbitolites*, 1801.] [Structure.]

—— **compressa**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, 1839, "Foraminifères," 66, viii, 4–7; also in Spanish, 1840, p. 83, same pl. & fig.

—— —— —— J., P. & B., Crag Foram., Pal. Soc. XIX, 1866, 21, iii, 43.

—— **concava** (Lamarck). Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 96. [*Orbulites*, 1816.]

—— **malabarica**, Carter. Ann. Mag. Nat. Hist. [3], VIII, 1861, 462; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 88. [*Orbitolites*, 1853.]

—— **nummata**, Lamarck. Ency. Méthod., "Vers," III (1832), 669 (pls. 1827) (P. & J. quote pt. 23, 1816), 468, f. 1.

—— —— **(numismalis)**, Lam. Blainville, Malacol. 1825, 373, vii, 4. [= *Naut. orbiculus*, F. & M. = *Orbic. adunca* (F. & M.).]

—— **numismalis**, Lamarck. Hist. Anim. s. Vert. VII, 1822, p. 609, No. 1.

—— —— —— Defrance, Dict. Sci. Nat. XXXII, 1824, 180; XXXVI, 1825, 291; Atlas, Conch. xv, 4. [= *Naut. orbiculus*, F. & M. = *Orbic. adunca* (F. & M.).]

—— —— —— Blainville, Manuel Malac. et Conch. 1825 (pls. 1838), 373, vii, 4.

—— —— —— D'Orbigny, Ann. Sci. Nat. VII, 1826, 305, No. 1, xvii, 8–10.

—— —— —— D'Orbigny, Modèles, No. 20, 1826.

—— —— —— Cuvier, Animal Kingdom, Henderson's ed. III, 1834, (pls. 1837), 18, iv*bis*, 4.

—— —— —— Cuvier, Règne Animal, 1836–46, IX (pls. X), 35, xiv, 1.

ORBICULINA numismalis, Lam. Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1838, 143, iii, i. [= *O. adunca* and var. *orbiculus* (F. & M.).]

——— ——— ——— Reeve, Conch. system. II, 1842, 289, ccxcvii, 2.

——— ——— ——— Beudant, Géologie, ed. 8, 1858, 117, fig. 106; later eds. same fig.

——— ——— ——— P., J. & B. [D'O., Modèles, 20], Ann. Mag. Nat. Hist. [3], XVI, 1865, 22, i, 21. [= *O. adunca*, F. & M.]

——— [**nummismalis**, d'Orb.]. Zittel, Handbuch Palaeont. Abth. I, 1876, 79, fig. 13^3.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 164, fig.

——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1057, lxxxvi, 47.

——— **rotella**, d'Orbigny. Foram. Fossiles Vienne, 1846, 142, vii, 13 and 14. [v. *Alveolina*.]

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 199, $xxxv^2$, 3*a*, *b*.

——— ——— ——— Pictet, Traité de Paléont. 2 ed. IV, 1857, 506, cix, 26.

——— **uncinata**, Lamarck. Hist. Anim. s. Vert. VII, 1822, p. 609, No. 3. [= *O. adunca* (F. & M.).]

——— ——— ——— Crouch, Introd. Lamarck, 1827, 40, xx, 10.

——— ——— ——— Brown, Conch. Text-book, 1839, 62, x. 19.

——— ——— ——— Brown, Elem. Foss. Conch. 1843, 24, ii, 31.

——— **universa**, d'Orb. Reeve, Conch. system. II, 1842, 288, ccxcvii, 1. [Misprint for *Orbulina*.]

——— ——— ——— Philippi, Neues Jahrb. 1843, p. 569. [Misprint for *Orbulina*.]

——— n. sp. Williamson, Trans. Micros. Soc. London, III, 1852, 117, xviii, 11–14. [Williamson described this form from Tonga, without, however, giving it a specific name. Carpenter, in Challenger Report, Orbitolites, 1883, p. 29, quotes it as "*Orbiculina tonga*, Williamson," and refers it to *Orbitolites complanata*, Lam.]

——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 374, 1, 6–8.

——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 192, vi, 2, *A–E*.

——— Carpenter, Journ. Quekett Microsc. Club, [2], II, 1885, 95, fig. 7. [Structural.]

——— see *Nautilus*.

ORBICULITES lenticulata (Lam.). Defrance, Dict. Sci. Nat., Atlas, Zooph. 1816–30, li, 5; and Blainville, Actinol. 1834, lxxii, 2. [v. *Orbitolites*.]

ORBIGNYNA, v. Hagenow. Neues Jahrbuch, 1842, p. 573.

——— **ovata**, v. Hagenow. Neues Jahrbuch, 1842, 573, ix, 26. [v. also *Lituola*; *Haplophragmium*.]

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 665, xxiv, 32.

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 84, $xxix^1$, 11.

ORBIS foliaceus, Philippi. Enum. Mollusc. Siciliae, II, 1844, 147, xxiv, 25, [error for 26]. [v. *Cornuspira* and *Spirillina*.]

——— **infimus**, Strickland. Quart. Journ. Geol. Soc. II, 1846, 30, fig. *a*. [v. *Ammodiscus* and *Cornuspira*.]

——— Lea. A genus of *Gasteropoda*.

ORBITOIDES, d'Orbigny, 1847. Prodrome de Paléont. II, 1850, 334.

——— **alpina**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 406, No. 1297.

——— **(Discocyclina) applanata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 700, iii, 17, 18, 35–37.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 71, xi, 2; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 82, same pl. and fig.

ORBITOIDES (Discocyclina) applanata, Gümbel. Jennings, Geol. Mag. dec. 3, v, 1888, 531, xiv, *3a, b, c, d*.

——— **(Discocylina) aspera**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 698, iii, 13, 14, 32–34.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 72, xi, 4 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 82, same pl. and fig.

——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 77.

——— **asterifera**, Carter. Ann. Mag. Nat. Hist. [3], VIII, 1861, 451, xvii, 3 ; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 78.

——— **asteriscus**, Michelotti. Nat. Verh. Holland. Maat. Wet. Haarlem, 2, xv, 1861, 17, i, 1 and 2.

——— ——— ——— Kaufmann, Beitr. geol. Karte Schweiz, Lief. v, 1867, 155, ix, 11–16.

——— **(Lepidocyclina) burdigalensis**, Gümbel. Abh. k. bay. Ak. Wiss. x, 1868 (1870), p. 719.

——— **carteri**, Martin. Junghuhn, Tertiärsch. Java, 1879–80, 161, xxviii, 2.

——— ——— ——— K. Martin, Niederländ. Arch. Zoöl. v, Heft 2, 1880, xiv, 2.

——— **crassula**, Mayer. Beitr. geol. Karte Schweiz, XIV, 2 Abth., 1877, 23, i, 2.

——— **decipiens**, v. Fritsch. Palaeontographica, Supp. III, Lief. 1, 1878, 143, xviii, 12 ; xix, 4.

——— **dilabida**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 140, xxix (62), *7a–e*.

——— **dilatata**, Michelotti. Nat. Verh. Holland. Maat. Wet. Haarlem, 2, xv, 1861, 17, i, 1 and 2.

——— **(Lepidocyclina)** ——— ——— Gümbel, Abh. m.-ph. Cl. k. bayer. Ak. Wiss. x, 1868 (1870), 717, iv, *45a, b*, 46, 47.

——— **discus** (Rütim.) (charact. addit.). Kaufmann, Beitr. geol. Karte Schweiz, Lief. v, 1867, 160, x, 11–16. [v. *Orbitolites*.]

——— **dispansa** (Sow.). Carter, Ann. Mag. Nat. Hist. [3], VIII, 1861, 447, xvi, 1, xvii, 1 ; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 73. [*Lycophris*, 1837.]

——— **(Discocyclina)** ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 701, iii, 40–47.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 132, ii, *10a, b* ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 138, same pl. and fig.

——— ——— ——— Brady, Geol. Mag. dec. 2, vol. II, 1875, 536, xiv, *2a, b, c*.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 72, xi, 3; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 82, same pl. and fig.

——— ——— ——— v. Fritsch, Palaeontographica, Supp. III, Lief. 1, 1878, 142, xviii, 10 ; xix, 8.

——— ——— ——— Brady, Jaarb. Mijn. Ned. Oost-Indie, VII, 2, 1878, 164, ii, *2a, b, c*.

——— ——— ——— Medlicott & Blanford, Geol. of India, 1879, 340 and 459, xv, 8.

——— **(Discocyclina)** ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xii, 16.

——— ——— ——— Martin, Samml. geol. Reichsmus. Leiden, [1], vol. I, Heft 2, 1881, 112, vi, 1, 2, and 3.

——— ——— ——— v. nov. Abich, Geol. Forsch. Kaukas. Ländern, II, 1882, 229, ii, 9 ; x, 1–4, 8 ; xi, 1–3.

——— **(Discocyclina)** ——— ——— Jennings, Geol. Mag. dec. 3, v, 1888, 530, xiv, 6.

ORBITOIDES nummulitica, Gümbel. Steinmann, Elem. Paléont. I, 1888, 36, fig. 23, *C*.
——— **nupera**, Conrad. Amer. Journ. Sci. XLIII, 1867, p. 31. [Cf. *Orbitolites supera*.]
——— **omphalus**, v. Fritsch. Palaeontographica, Supp. III, Lief. 1, 1878, 142, xviii, 13; xix, 5.
——— **orakeiensis**, Karrer. Novara-Exped., Geol. Theil, I, 1864, 86, xvi, 21.
——— (**Discocyclina**) **papyracea** (Boubée). Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 690, iii, 3–12, 19–29. [v. *Nummulites*.]
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 132, ii, 9*a*, *b*; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 138, same pl. and fig.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 71, xi, 1; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 81, same pl. and fig. [*O. papiracea*, in descr. of plate.]
——— ——— ——— Brady, Geol. Mag. dec. 2, II, 1875, 535, xiv, 1*a*, *b*, *c*, *d*.
——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 103, fig. 43[1, 2, 3].
——— ——— ——— Brady, Jaarb. Mijn. Ned. Oost-Indie, VII, 2, 1878, 163, ii, 1*a*, *b*, *c*, *d*.
——— ——— ——— v. Fritsch, Palaeontographica, Supp. III, Lief. 1, 1878, 140, xviii, 14. [Structure.]
——— ——— ——— Hantken, Kohlenflötze, etc. ungar. Krone, 1878 (transl. from Magyar), 225, fig. 38.
——— ——— ——— Medlicott & Blanford, Geol. of India, 1879, 461, xv, 7.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xii, 20 and 21.
——— ——— ——— Abich, Geol. Forsch. Kaukas. Ländern, 1882, 242, ix, 2, 2*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 126, xiii (xxi), 7*a*, *b*.
——— ——— ——— Steinmann, Elem. Paléont. I, 1888, 36, fig. 23, *A*, *B*, *F*, *H*, *I*.
——— (**Discocyclina**) ——— ——— Jennings, Geol. Mag. dec. 3, v, 1888, 530, xiv, 5.
——— (**Aktinocyclina**) **patellaris** (Schlotheim). Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 711, iv, 29–32. [*Asteriacites*, 1822.]
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 132, ii, 31*a*, *b* [error for 11*a*, *b*]; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 139, same pl. and fig.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 72, xi, 6; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 83, same pl. and fig.
——— **prattii**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 167, iv, ii, etc. [See also *O. microthalma* and *O. javanicus*.] [Glauc.]
——— (**Asterocyclina**) **priabonensis**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 715, iv, 3*b*, *a*, *b*, 41 [40].
——— (**Asterocyclina**) ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xii, 17.
——— (**Aktinocyclina**) **radians** (d'Arch.). Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 707, ii, 116*a*–*d*; iv, 11–15 [14 = v. *furcata*]. [*Orbitolites*, 1848.]
——— ——— (?) var. **scarantana**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), iv, 41*a*, *b*.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 132, ii, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 139, same pl. and fig.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 72, xi, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 83, same pl. and fig.
——— ——— ——— Steinmann, Elem. Paléont. I, 1888, 36, fig. 23, *D*.

ORBITOIDES radiata, Martin. Junghuhn, Tertiärsch. Java, 1879–80, 163, xxviii, 4.

——— ——— ——— Martin, Niederländ. Arch. Zool. v, Heft 2, 1880, xiv, 4.

——— (**Asterocyclina**) **stella**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 716, ii, 117*a*, *b*, *c*; iv, 8–10, 19.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 73, xi, 10; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 84, same pl. and fig.

——— (**Asterocyclina**) ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xii, 18.

——— (**Asterocyclina**) **stellata** (d'Archiac). Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 713, ii, 115*a–e*; iv, 4–7. [*Calcarina*, 1846.]

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, I, 1871, 133, ii, 8*a*, *b*, *c*; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, p. 139, same pl. and fig.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 73, xi, 9; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 84, same pl. and fig.

——— ——— ——— Hantken, Kohlenflötze, etc. ungar. Krone, 1878 (transl. from Magyar), 226, fig. 40.

——— (**Asterocyclina**) ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xiii, 1.

——— ——— ——— Steinmann, Elem. Paléont. I, 1888, 36, fig. 23, *E*.

——— (**Asterocyclina**) ——— [Gümb.]. Jennings, Geol. Mag. dec. 3, v, 1888, 531, xiv, 7.

——— ——— ——— Howchin, Trans. R. Soc. Austral. XII, 1889, 17, i, 9–11.

——— (**Rhipidocyclina**) **strophiolata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 705, iv, 25–28.

——— **sumatrensis**, Brady. Geol. Mag. dec. 2, II, 1875, 536, xiv, 3*a*, *b*, *c*.

——— ——— ——— Brady, Jaarb. Mijn. Ned. Oost-Indie, VII, 2, 1878, 165, ii, 3*a*, *b*, *c*.

——— (**Discocyclina**) **tenella**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 698, iii, 1, 2, 30 and 31.

——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 103, fig. 43^4.

——— (**Aktinocyclina**) **tenuicostata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 709, ii, 114*a*, *b*, *c*; iv, 35.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 73, xi, 7 and 8; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), p. 83, same pl. and fig.

——— **varians**, Kaufmann. Beitr. geol. Karte Schweiz. Lief. v, 1867, 158, x, 1–10.

——— (**Aktinocyclina**) **variecostata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 710, iv, 33*a*, *b*, 34.

——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 103, fig. 43^5.

——— (**Actinocyclina**) ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 215, xii, 19.

[———] Targiona, Relaz. d'alc. viaggi, IV, 1770, p. viii, pl. i, figs. 3–5. See *Corpi marini*.

——— Carpenter, Parker & Jones, Introd. Foram. 1862, 298, xx.

——— ? sp. v. Fritsch, Palaeontographica, Supp. III, Lief. 1, 1878, 145, xviii, 17.

——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 382, fig. 30–32.

——— Martin, Jaarb. Mijn. Nederland. Oost-Indië, XI, 1882, 80, 82, 90, iii, 1–4. [Structural.]

——— **ind.** Abich, Geol. Forsch. Kaukas. Ländern, II, 1882, 235, x, 5.

——— Carter, Ann. Mag. Nat. Hist. [6], II, 1888, 439. [Notes on Genus.]

——— Malagoli, Atti Soc. Nat. Modena, [3], VII, 1888, 115, v, 2.

——— see *Aktinocyclina*; *Asterocyclina*; *Discocyclina*; *Lepidocyclina*; and *Rhipidocyclina*.

ORBITOLINA, d'Orbigny, 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 143.
——— **annularis**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, 31.
——— **concava**, P. & J. Lyell, Antiq. of Man, ed. 4, 1873, p. 64, fig. 22. [= *Porosphæra.*]
——— ——— ——— Martin, Jaarb. Mijn. N. I. XVIII, 1889, 88, xxiv and xxv.
——— ——— Lamarck. v. *Orbulites.*
——— **conica**, d'Arch. Mém. Soc. géol. France, II, 1837, 178.
——— **conoidea**, Gras. Catal. Corps Org. Foss. Isère, 1852, 34, 37, 52, i, 4–6.
——— **discoidea**, Gras. Catal. Corps Org. Foss. Isère, 1852, 37 and 52, i, 7–9.
——— **gigantea**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 279, No. 1350.
——— **globularis** (d'Orb.). Jones, Geologist, 1862, 336. [= var. of *O. concava* (Lam.).] [= *Porosphæra.*]
——— **lævis**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, 32. [v. *Tinoporus.*]
——— **lenticularis**, Lam. Carter, Ann. Mag. Nat. Hist. [3], VIII, 1861, 458, xvii, 5; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 84. [v. *Orbulites*, 1816.]
——— **lenticularis** (Blumenbach). Pictet & Renevier, Mat. paléont. Suisse, [1], Mém. 1, 1858, 166, xxiii, 3*a–f*. [*Madreporites*, 1805.]
——— ——— ——— Heer, Urwelt Schweiz, 1865, 203, fig. 115; and transl. London, 1876, 213, fig. 115.
——— **lenticulata** (Lamarck), (d'Orb.), 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 143, No. 342. [See *Orbitolites*, Lamarck and Lamouroux, and *Orbulites*, 1816.]
——— ——— ——— Pictet, Traité de Paléont. 2 ed. IV, 1857, 486, cix, 7.
——— **mamillata**, d'Arch. Mém. Soc. géol. France, II, 1837, 178.
——— **media**, d'Arch. Mém. Soc. géol. France, II, 1837, 178.
——— **patula**, Carter. Geol. Papers Western India, 1857, 549, not fig'd.
——— **plana**, d'Arch. Mém. Soc. géol. France, II, 1837, 178.
——— **radiata**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 280, No. 1351.
——— **semiannularis**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, 30.
——— **simplex**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, 29.
——— **sphærulata**, P. & J. Ann. Mag. Nat. Hist. [3], 1860, 34.
——— **sphærulolineata**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, 34.
——— **vesicularis**, P. & J. Ann. Mag. Nat. Hist. [3], VI, 1860, p. 31, No. 5; and var. *congesta*, No. 6. [v. also *Gypsina* and *Tinoporus.*]
——— ——— ? Carter, Ann. Mag. Nat. Hist. [3], VIII, 1861, 459, xvii, 6–9; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 85.

ORBITOLITES, Lamarck, 1801. Syst. Anim. sans Vert. 1801, p. 376; Brady, Report Challenger, 1884, p. 210, fig. 6.
——— **arabica**, Carter. Ann. Mag. Nat. Hist. [3], VIII, 1861, 463, xvii, 10–14; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 90. [*Operculina* in description to plates, q. v.]
——— **complanata**, Lamarck. Syst. Anim. sans Vert. 1801, p. 376. [v. *Orbiculina* and *Orbitulites.*]
——— ——— ——— Defrance, Dict. Sci. Nat. XXXVI, 1825, 294; Atlas, Zooph. xlvii, 2.
——— ——— ——— Blainville, Actinologie, 1834, lxxii, 2.
——— ——— ——— Galeotti, Mém. Couronnés Ac. R. Bruxelles, XII, 1837, Mém. iii, 164, iv, 5.
——— ——— ——— Michelin, Icon. Zoophytol. 1840–47, 167, xlvi, 4*a*, *b*.
——— [**complanatus**] ——— Harting, Magt van het Kleine, 1866, 103, fig. 45.
——— ——— ——— Greene, Man. Protozoa, London, 1871, 19, fig. 4.
——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 79, fig. 13[4], and fig. 16.

ORBITOLITES complanata, Lam. Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 81, iv [numbered iii, by error], 4 and 5 ; v, 1–5. [Structural.]

——— [**complanatus**] ——— Carpenter, The Microscope, ed. 6, 1881, 553, fig. 316, 317, and 319.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 125, xiii (xxi), 5.

——— ——— ——— Carpenter, Phil. Trans. 1883, 562, etc. figs. iii and iv. [Structural.]

——— ——— ——— Carpenter, Report Challenger, " Orbitolites," 1883, 29, v, 11–18 ; vi, vii, and viii.

——— ——— ——— Carpenter, Report Challenger, " Orbitolites," 1883, 13, fig. 3. [Structural.]

——— ——— ——— [v. **laciniata**]. Carpenter, Report Challenger, " Orbitolites," 1883, 36, vii.

——— [**complanatus**] ——— Jones, in Microgr. Dict. ed. 4, 1883, 557, xxiii, 17*a*, *b*.

——— ——— ——— Brady, Report Challenger, 1884, 218, xvi, 1–6, and xvii, 1–6. [*O. laciniatus*, 1881.]

——— ——— ——— v. **laciniata**. Brady, Report Challenger, 1884, 220, xvi, 8–11.

——— ——— ——— Carpenter, Journ. Quekett Microsc. Club, [2], II, 1885, 91, fig. 4 and 10.

——— ——— ——— Bütschli, Morph. Jahrb. XI, 1886, 80, vii, 1–5.

——— ——— ——— Fritel, Foss. caract. terr. sedim. tert. 1886, pl. vii, 58 and 59.

——— ——— ——— v. **laciniata**. Brady, Journ. R. Microsc. Soc. 1888, 693, x, 1–14.

——— **concava**, Lamarck. Syst. Nat. Anim. s. Vert. 1801, p. 376.

——— ——— ——— Michelin, Icon. Zoophytol. 180, 1840–1847, 28, vii, 9.

——— **crassa**, Fischer. Fond de la Mer, I, chap. XVII (1870), p. 253, not figured.

——— [**Cyclolina**] **cretacea**, d'Orbigny. Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 192, viii, 16. [*Cyclolina*, 1846.]

——— **discoidea**, Lea. Contrib. to Geology, 1833, 192, vi, 205. [= ?]

——— **disculus**, Leymerie. Mém. Soc. géol. France, [2], IV, 1851, 190, ix, 1*a–d*.

——— **discus**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, 116, v, 70, 71 (78, 80), 81.

——— **duplex**, Carpenter. Phil. Trans. CLXXIV, 1883, 561, etc., figs. ii and v.

——— ——— ——— Carpenter, Report Challenger, " Orbitolites," 1883, 25, iii, 8–14 ; iv, 6–10 ; v, 1–10 ; p. 28, fig. 4.

——— ——— ——— [**hemprichii**, Ehr. **sp**. ?]. Brady, Report Challenger, 1884, 216, xvi, 7 ; and fig. 7, p. 217. [*Amphisorus*, 1838.]

——— ——— ——— Carpenter, Journ. Quekett Microsc. Club, [2], II, 1885, 97, fig. 9. [Structural.]

——— **elliptica**, Michelin. Icon. Zoophytol. 1840–1847, 277, lxi, 11*a*, *b*.

——— **fortisii**, d'Archiac. Mém. Soc. géol. France, [2], III, 1848, 404, viii, 10*a*, 11*a*, 12*a*. [v. *Orbitoides*.]

——— ——— ——— v. **A**, Roualt. Mém. Soc. géol. France, [2], III, 1848, 463, xiv, 6*a*.

——— **furcata**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, 118, v, 75 (79).

——— **gensacica**, Leymerie, v. κ, **gigantea**. Mém. Soc. géol. France, [2], IV, 1851, 190, ix, 2*a–d*.

——— ——— ——— v. β, **concava**. Mém. Soc. géol. France, [2], iv, 1851, 190, ix, 3*a–d*.

——— **interstitia**, Lea. Contrib. to Geology, 1833, 191, vi, 204. [= ?]

——— **italica** (Costa). Brady, Ann. Mag. Nat. Hist. [5], XVI, 1886, p. 191. [*Pavonina*, 1856.]

ORBITOLITES karakaiensis, d'Archiac. Hist. Progrès Géol. III, 1850, p. 231. [v. also *Orbitoides*.]

——— **laciniatus**, Brady. Quart. Journ. Micr. Soc. XXI, 1881, p. 47. [v. *O. complanata*, var. *laciniata*.]

——— **lenticulata**, Lamarck. Defrance, Dict. Sci. Nat. XXXVI, 1825, 295; Atlas, Zooph. li, 5. [*Orbulites lenticulata*, 1816.]

——— ——— ——— Cuvier & Brongniart, in Cuvier, Ossem. fossiles, ed. 2, II (2), 333 and 613, pl. ix, f. 4*A*, *B*, *C*.

——— ——— [Al. Brongn.]. Bronn, Syst. urweltl. Pflanzenthiere, 1825, 23, vi, 18.

——— **macropora**, Lamarck. Reuss' Models, No. 90, 1865 [Catal. No. 30, 1861]. [v. *Orbulites*.]

——— **malabarica**, Carter. Ann. Mag. Nat. Hist. [2], XI, 1853, 425, xvi, *B*, 1–4.

——— **malabaricus**, Carter. [v. *Orbiculina adunca*.]

——— **mammillaris**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 144, no. fig.

——— **mantelli**, Carter. Journ. Bombay Br. R. Asiatic Soc. v, pt. XVIII (1853), 138, ii, 30–39. [This is *Nummulites mantelli*, Morton.]

——— ——— ——— Carter, Ann. Mag. Nat. Hist. [2], XI, 1853, 174, vii, 30–39 (40, 41?).

——— ——— ——— Carter, Geol. Papers Western India, 1857, 547, xxiii, 30–39.

——— ——— ——— Carter, Ann. Mag. Nat. Hist. [3], VIII, 1861, 452, xvi, 2, xvii, 2; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 79.

——— ——— ——— v. **theobaldi**, Carter. Ann. Mag. Nat. Hist. [6], II, 1888, 342.

——— **marginalis**, Lamarck. Carpenter, Phil. Trans. 174, 1883, 560, fig. i. [*Orbulites*, 1816.]

——— ——— ——— Carpenter, Report Challenger, "Orbitolites," 1883, 20, iii, 1–7; iv, 1–5.

——— ——— ——— Brady, Report Challenger, 1884, p. 214, xv, 1–5.

——— ——— ——— Carpenter, Journ. Quekett Microsc. Club, [2], II, 1885, 96, fig. 8. [Structural.]

——— **marginata**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 144, no fig.

——— **orbiculus** (Förskal). J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, 23, iii, 45–47. [*Nautilus*, 1775.]

——— **papillosa**, Savi & Meneghini. Consid. Geol. Toscana, 1851, 144, no fig.

——— **papyracea**, d'Archiac. Mém. Soc. géol. France, [2], III, 1848, 405, viii, 13*a*.

——— **parmula**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, 117, v. 72 and 73.

——— **patellaris**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, 119, v, 76 and 77 (79).

——— **pedunculata**, Carter. Ann. Mag. Nat. Hist. [3], VIII, 1861, 463; Journ. Bombay Branch R. Asiatic Soc. VI, 1861 (1862), 89. [*Cyclolina*, 1853.]

——— **pratti**, Michelin. Icon. Zoöphytol., 1840–47, 278, lxiii, 14. [v. also *Orbitulites*.]

——— **radians**, d'Archiac. Mém. Soc. géol. France, [2], III, 1848, 405, viii, 15*a*.

——— **secans**, Leymerie. Mém. Soc. géol. France, [2], IV, 1851, 191, ix, 4*a*, *b*.

——— **sella**, d'Archiac. Mém. Soc. géol. France, [2], III, 1848, 405, viii, 16*a*.

——— **socialis**, Leymerie. Mém. Soc. géol. France, [2], IV, 1851, 191, ix, 5*a*, *b*, *c*.

——— **stellaris**, Brunner [MS.]. Rütimeyer, Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, 118, v, 74 (78).

ORBITULINA cretacea, Schafhäutl. Süd-Bayerns Lethaea Geogn. 1863, not descr. xv, 1*a*, *b*.
——— **lenticularis** (Lam.). Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 93, xxix², 22*a–c*. [*Orbulites*, 1816.]
——— **venezuelana**, Karsten. Géol. Colomb. bolivarienne, etc. 1886, 62, vi, 6*a*, *b*, *c*, *d*, *e*. [*Orbitulites lenticularis*, ?, *K*, 1856.]
ORBITULITES,* Bronn, 1837. Lethaea Geognostica, ed. 2, I, 1837, p. 596.
——— **africanus**, J. E. Gray. Spicil. Zool. 1828, 8. [*nom. nud.?* Foraminifer.]
——— **angulata**, Catullo. Dei Terreni sed. sup. Venezie, 1857, 27, i, 11.
——— **apertus**, Ermann. Zeitschr. deutsch. geol. Ges. VI, 1854, 603, xxiv [error for xxiii], 1–3.
——— **cassianicus**, Schauroth. Sitz. k. Ak. Wiss. Wien, XVII, 1855, 527, ii, 13.
——— **circumvulvata**, Gümbel. Neues Jahrbuch, 1872, 259, vii, 11–18.
——— **complanata** (Lamarck). [v. *Orbitolites*.]
——— [**complanatus**], Lam. Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 254, xxxv, 22*a*, *b*.
——— ———? ——— Catullo, Dei Terreni sed. sup. Venezie, 1857, 26, i, 10.
——— cf. ——— ——— Schwager, Palaeontographica, XXX, 1883, Pal. Theil, 90, xxiv (1), 10*a–d*.
——— **concava** (Lamarck). [*Orbulites*, 1816.]
——— ——— [Defrance]. Gümbel, Anleit. Geol. Beob. Alpenreisen, Zeitschr. D. & Ö. Alpenver., Beilage, 1878, 132, fig. 45, 5.
——— **convexo-convexa**, Catullo. Dei Terreni sed. sup. Venezie, 1857, 25, i, 7.
——— **creplini**, Hagenow. N. Jahrb. 1839, 289. [= *Myriopora*, *fide* Bronn, Index Pal. 1848, 768.]
——— **incertus**, Karrer. Novara-Exped., Geol. Theil, I, 1864, 79, xvi, 10.
——— **lenticularis**, *sp. nov.* ?, Karsten. Amtlicher Ber. 32 Vers. deutsche Nat. Aerzte, Wien, 1856, (1858), 114, vi, 6*a*, *b*, *c*, *d*, *e*. [v. *Orbitulina venezuelana*.]
——— **lenticulata** (Lamarck). Gümbel, Anleit. geol. Beob. Alpenreisen, Zeitschr. D. & O. Alpenver., Beilage, 1878, 131, fig. 43, 10. [*Orbulites*, 1816.]
——— **macropora** (Lamarck). Goldfuss, Petrif. German. I, 1826–33, 41, xii, 8. [*Orbulites*, 1816.]
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–1846, 626, xxiii, 51.
——— ——— ——— Hagenow, Bryozoen Maestrichter Kreide, 1850, 103, xii, 17*a–c*.
——— **marginatus**, Lam. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl. iii. [*Orbulites marginalis*, 1816.]
——— **nummuliformis**, Catullo. Dei Terreni sed. sup. Venezie, 1857, 27, i, 12. [*Stromatopora* of Lonsdale, fig'd by Pictet, Traité de Pal. IV, 1846, 321, xvi, 14.]
——— **pharaonum**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 91, xxiv (1), 9*a bis*, *d*.
——— **praecursor**, Gümbel. Neues Jahrbuch, 1872, 256, vii, 1–10.
——— **pratii**, Michelin. Catullo, Dei Terreni sed. sup. Venezie, 1857, 26, i, 9. [*Prattii* on pl.]. [*Orbitolites*, 1840.]
——— **roncana**, Catullo. Dei Terreni sed. sup. Venezie, 1857, 25, i, 8.
——— **tenuissimus**, Carpenter. Abich, Geol. Forsch. Kaukas. Ländern, 1882, 243, fig. 41. [v. *Orbitolites*.]
——— **texanus**, Roemer. Kreidebild. Texas, 1852, 86, x, 7*a*, *b*, *c*, *d*.
——— Faujas de St. Fond, Hist. Nat. Mont. St. Pierre Maestricht, 1799, 186, xxxiv, 1–4.

* This term was first used by Faujas de St. Fond, Hist. Nat. Mont. St. Pierre Maestricht, 1799, pp. 186, 187. He quotes *Orbitolites*, Lamarck, Syst. 1801, p. 376, and we can only presume that he was favored by Lamarck's opinion on his specimens.

* See Sherborn, Bibl. Foram. 1888, p. 32.

ORBULINA universa, d'Orbigny. Pictet, Traité de Paléont. IV, 1846, 218, xii, 1; and 2d ed. 1857, 483, cix, 2.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 22, i, 1.
——— ——— ——— D'Orbigny, Cours élém. Paléont. etc. I, 1849, 192, fig. 315 ; II, fas. 2, 1852, 815, fig. 621.
——— ——— ——— Harting, Magt van het Kleine, 1849, iii, fig. 1 ; and 1866, 100, fig. 36 ; German by Dr. A. Schwartzkoff, 1851, 81.
——— ——— ——— Bailey, Smithsonian Contrib. II, 1851, 9, pl., 1.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2 (1856), 114, xi, 5*a*, A, B.
——— ——— ——— Dawson, Canad. Nat. II, 1857, 422, vii, 21. [= *Lag. globosa*, W. & J.]
——— ——— ——— Williamson, Recent British Foram. 1858, 2, i, 4.
——— ——— ——— Mackie, Recreative Science, I, 1859, 147, fig. 8.
——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 176, xii, 8.
——— ——— ——— Mangin, Mystères Océan, 1864, 177, fig. 10.
——— ——— ——— Parker & Jones, Phil. Trans. 1865, 364, xvi, 13 and 14.
——— ——— ——— Reuss' Models, No. 74, 1865. (Catal., No. 92, 1861.)
——— ——— ——— Mackie, Science Gossip, 1867, 129, fig. 104.
——— ——— ——— Figuier, Ocean World, [1873], p. 84, fig. 17.
——— ——— ——— Wy. Thomson, Depths of Sea, 1873, 23, fig. 3.
——— ——— ——— Toula, Mitth. geogr. Ges. Wien, XVIII, 1875, 165, pl., 12.
——— ——— ——— Wy. Thomson, Proc. Roy. Soc. XXIII, 1875, 35, ii.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 67, vii, 1; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Anon., Amer. Journ. Micros. I, 1876, 128, figs. 2 and 3.
——— ——— ——— Zittel, Handbuch Palaeont. I, 1876, 88, fig. 24^1.
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 472, xviii, 32.
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 45.
——— ——— ——— Wy. Thomson, Voyage Challenger, 1877, ii, 215, fig. 47.
——— ———? ——— Hopkins, Execut. Doc. 45 Congress, Sess. 3, IV, Rpt. Chief Engineers, pt. 2, App. W, 1878–79, 885, ii, 73.
——— ——— ——— Nicholson, Manual Palaeont. 1879, i, 100, fig. 14.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 201, vii, 30.
——— ——— ——— Abich, Geol. Forsch. Kaukas. Ländern, 1882, 241, fig. 40.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 24, 1 (ix), 1.
——— ——— ——— Schlumberger, F. Jeun. Nat., Jany. 1882, i, 1.
——— ——— ——— Jones, in Micr.gr. Dict. ed. 4, 1883, 557, xxiv, 1.
——— ——— ——— Schlumberger, Comptes Rendus, XCVIII, 1884, 1002, figs. 1 and 2 ; and Ann. Mag. Nat. Hist. [5], XIV, 1884, 69.
——— ——— ——— Brady, Report Challenger, 1884, 608, lxxviii ; lxxxi, 8–26 ; lxxxii, 1–3; double specimens, lxxxi, 20 and 21 ; lxxxii, 2 and 3.
——— ——— ——— Woodward & Thomas, 13 Ann. Rep. Geol. N. H. Survey Minnesota, for 1884 (1885), 174, iv, 25–31.
——— ——— ——— Gümbel, Geol. Bayern, Th. I, Lief. 2, 1885, fig. 266, 14.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. v (1885), 1049, lxxxvi, 1.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 756, xvi, 9.
——— ——— ——— Hogg, Microscope, 1886, 384, iii, 75, 76, and 78.
——— ——— ——— Malagoli, Boll. Soc. geol. Ital. VI, 1887, 522, xiii, 9.
——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 166, fig. 510 and 512.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 225, xlv, 7, 8, 14.
——— ——— ——— D'Orbigny. See *Sphærulæ vitræ*.

ORTHOCERA jugosa [Montagu]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 13. [*Nautilus*, 1803.]
——— ——— ——— Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, i, 13.
——— **legumen** [Linn.]. Lamarck, Ency. Méthod., "Vers," n. d. (pls. 1827), 465, f. 3. (P. & J. quote pt. 23, 1816.) [*Nautilus*, 1758.]
——— ——— ——— Lamarck, Hist. Anim. s. Vert. VII, 1822, p. 595. [*Nautilus*, 1758.]
——— ——— ——— Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 21 and 23.
——— **linearis** [Montagu]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 14 and 15. [*Nautilus*, 1808.]
——— ——— ——— Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, i, 14 and 15.
——— **obliqua** (Linn.). Lamarck, Hist. Anim. s. Vert. VII, 1822, p. 594. [*Nautilus*, 1758.]
——— **radicula** [Linn.]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 28 and 25. [*Nautilus*, 1758.]
——— **raphanistrum** (Linn.). Lamarck, Hist. Anim. s. Vert. VII, 1822, p. 594. [*Nautilus*, 1758.]
——— **raphanoides**, Lamarck. Syst. Anim. s. Vert. 1801, p. 103. [v. *O. raphanus*.]
——— **raphanus** [Linn.]. Lamarck, Ency. Méthod., "Vers," n. d. (pls. 1827), 465, f. 2. (P. & J. quote pt. 23, 1816.) [*Nautilus*, 1758.]
——— ——— [Lam.]. Bronn, Syst. urweltl. Conchyl. 1824, 9, i, 2 [error for 1].
——— ——— ——— Crouch, Introd. Lamarck, 1827, 39, xx, 5.
——— ——— ——— Brown, Conch. Text-book, 1839, 65, x, 28.
——— **recta** [Montagu]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 16, 19, 20. [*Nautilus*, 1803.]
——— ——— ——— Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, i, 16, 19, 20.
——— **septemcostata**, Brown. Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, i, 24. [= Montagu, pl. 19, f. 2.]
——— **spinulosa** [Montagu]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 26. [*Nautilus*, 1808.]
——— **subarcuata**, Brown. Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 18. [v. also *Nodosaria*.]
——— Woodward, Outline Geology Norfolk, 1833 [60], vi, 24. [Flint cast of interior of a *Nodosaria*.]

ORTHOCERAS, auct.
——— **auris**, Soldani. Testac. I, pt. 2, 1791, p. 98, pl. 104*A*. [*Planularia auris*, Defr. D'Orb., Ann. Sci. Nat. VII, 1826, p. 260, 6.] [= *Cristellaria*, q. v.]
——— **baculus**, Sold. Testac. II, 1798, p. 16, pl. 2*v*, *x*. [*Nod. glabra*, d'O. Ann. Sci. Nat. VII, 1826, p. 253, no. 12.]
——— **corniculum**, Sold. Testac. I, pt. 2, 1791, p. 98, pl. 105*K*. [*Nod. (Dent.) cornicula* [error for *corniculum*, Jones MS.], D'O. Ann. Sci. Nat. VII, 1826, p. 255, 47.]
——— **cuspis**, Sold. Testac. II, 1798, 34, pl. 9*P*. [*Frondic. digitata*, d'O. Ann. Sci. Nat. VII, 1826, p. 256, 6.]
——— ——— ——— Testac. II, 1798, 34, pl. 9*Q*, *R*. [*Frondic. striata*, d'O. Ann. Sci. Nat. VII, 1826, p. 256, 3.]
——— ——— ——— Testac. II, 1798, 34, pl. 9*S*. [*Frondic. pupa*, d'O. Ann. Sci. Nat. VII, 1826, p. 256, 4.]
——— ——— ——— Testac. I, pt. 2, 1791, p. 98, pl. 105*L*. [*Nod. (Dent.) aciculata*, d'O. Ann. Sci. Nat. VII, 1826, p. 255, 41.]
——— **decussata**, Perry. Conchology, 1811, pl. lii, fig. 2.
——— **farcimen**, Sold. Testac. II, 1798, 35, pl. 10*h*-*m*. [*Nodos. ovicula*, d'O. Ann. Sci. Nat. VII, 1826, 252, 6.]

ORTHOCERATA conico-cylindroidea, Soldani. Sagg. Oritt. 1780, 107, v, 37*P*. [= *Dentalina.*]

——— **crystallina, seu vere arundinea,** Soldani. Sagg. Oritt. 1780, 107, vi, 42*E*. [= *Dentalina.*]

——— **perfecte conica in acutum apicem definentia, circum nodosa striata,** etc., Soldani. Sagg. Oritt. 1780, 107, v, 37*Q*. [= *Nod. bacillum.*]

——— **perfecte globularia, quorum alia vitrea, lævis, . . . vel costata costis distantibus, lucidissima, . . . vel minima et microscopica . . .,** Soldani. Sagg. Oritt. 1780, 108, vi, 43*F–L*. [43*F*, *G*, *K*, *L*, = *Nodos. radicula; H* = *Nodos. bacillum; I* = *Dentalina.*]

——— **seu tubuli concamerati, recti, longitudinaliter striati, cylindroidei,** Soldani. Sagg. Oritt. 1780, 106, v, 37*M*, *N*, *O*. [= *Nodos. bacillum.*] [*N* = *D. obliquistriata.*]

——— **unilocularia, vel multilocularia, lævia, lucida . . .,** Soldani. Sagg. Oritt. 1780, 108, vi, 45*O–S*; vii, 45*T–Z* and *A*. [45*O* = *Gland. lævigata; P, R* = *Polymorphina; Q* = *Sphær. bulloides; S* = *Biloculina; T, Y* = *Q; V* = *Polymorph. communis; X* = *Polymorph. gutta; Z* = *Nodos. radicula; A* = *Polymorph. globularis.*]

——— **vaginulam gladii referentia,** Soldani. Sagg. Oritt. 1780, 108, vi, 44*M*, *N*. [= *Vagin. legumen.*]

ORTHOCERATIA, Soldani, 1780.

——— **anthocenæ,** Soldani. Testaceographia, II, 1798, 15, pl. 2*N*. [= *Nodos. glabra.*]

——— ——— ——— Sold., Testac. II, 1798, 15, pl. 2*O*. [*Nodos. nitida,* d'O. Ann. Sci. Nat. VII, 1826, 254, 33.]

——— **baculi,** Sold. Testac. I, 2, 1791, 96, pl. 102*B*. [*Nod. interrupta,* d'O. Ann. Sci. Nat. VII, 1826, 252, 11.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, 96, pl. 103*D*. [*Bigenerina lævigata,* d'O. Ann. Sci. Nat. VII, 1826, 261, 3.]

——— **conico-cylindroidea,** Sold. Sagg. Oritt. 1780, 107, pl. 5, 37*m*, *M*. [= *Nodos. affinis,* d'O.]

——— **filiformia,** Sold. Testac. II, 1798, 35, pl. 10*d*. [*Nodos. flexuosa,* d'O. Ann. Sci. Nat. VII, 1826, 254, 32.]

——— **filiformia aut capillaria,** Sold. Testac. II, 1798, 35, pl. 10*f*, *g*. [*Nodos. nodosa,* d'O. Ann. Sci. Nat. VII, 1826, 254, 31.]

——— ——— ——— Sold., Testac. II, 1798, 35, pl. 10*e*. [*Nod. filiformis,* d'O. Ann. Sci. Nat. VII, 1826, 253, 14.]

——— **flosculi,** Sold. Testac. I, pt. 2, 1791, 91, pl. 95*A*. [*Nodos. cancellata,* d'O. Ann. Sci. Nat. VII, 1826, 254, 29].

——— ——— ——— Sold., Testac. II, 1798, 34, pl. 9*L*. [*Dentalina floscula,* d'O. For. Foss. Vienne, 1846, 50, pl. 2, 16, 17.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, 91, pl. 95*B–M*. [*Nodos. longicauda,* d'O. Ann. Sci. Nat. VII, 1826, 254, 28.]

——— **hispida,** Sold. Testac. II, 1798, 36, pl. 11*n–z*, *A* and *B*. [*Nod. hirsuta,* d'Orb.]

——— **lævia,** etc., Sold. Testac. I, pt. 2, 1791, 92, pl. 97*bb* [?]. [*Dentalina inornata,* d'O. For. Foss. Vienne, 1846, 44, i, 50, 51. D'Orbigny's reference is wrong.]

——— **lituitata,** Sold. Testac. I, pt. 2, 1791, 95, pl. 100*bb*, *cc*. [*Marginulina lævigata,* d'O. Ann. Sci. Nat. VII, 1826, 259, 10.]

——— **pupa,** Sold. Testac. I, pt. 2, 1791, 99, pl. 108*D*. [*Vulvulina elegans,* d'O. Ann. Sci. Nat. VII, 1826, 264, 3.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, 99, pl. 108*vv*, *xx*. [*Vulvulina pupa,* d'O. Ann. Sci. Nat. VII, 1826, 264, 2.]

——— **quasi hispida,** Sold. Testac. II, 1798, 15, pl. 2*P*. [*Nod. hirsuta,* d'O. Ann. Sci. Nat. VII, 1826, 252, 7.]

* Given by d'Orbigny as a subgenus of *Nodosaria*.

ORTHOCERINA, sp. Dunikowski, Denkschr. k. Ak. Wiss. Wien, XLV, Abth. 2, 1882, 194, vi, 79.
——— Pictet, Traité de Paléont. IV, 1846, 219, xii, 3.
ORTHOCEROS, Mendes da Costa, Elem. Conch. 1776, 156, ii, 12 and 13.
ORTHOPLECTA, Brady, 1884. Report Challenger, 1884, 428.
——— **clavata**, Brady. See *Cassidulina*.
ORYZARIA, Defrance, 1820. Dict. Sci. Nat. XVI, 1820, 106.
——— **boscii**, Defrance. Dict. Sci. Nat. XVI, 1820, 106 ; Atlas, Zooph. xlviii, 4. [= *Alveolina sabulosa*.] [See *Borelis*, and *Alveolina*.]
——— ——— ——— Bronn, Syst. urweltl. Pflanzenthiere, 1825, 31, vii, 17*a*–*c*.
——— ——— ——— Blainville, Actinologie, 1834, lxxiii, 4.
OTHOCERINA, Tate & Blake, 1876, error for *Orthocerina*.
OTOSTOMUM, Ehrenberg, 1872. Monatsber. k. preuss. Ak. Wiss. Berlin, 1872, 276. [= ? *Bifarina*, Parker & Jones.]
——— **strophoconus**, Ehr. Monatsber. k. preuss. Ak. Wiss. Berlin, 1872, 287.
"**Ova of Polythalamia** ?" Bailey, Smithsonian Contrib. II, 1851, 13, pl., 49.
OVEOLITES margaritula, Montfort. Conch. Syst. II, 1810, 363, 91st genre. [= *Ovulites* of Lamarck.]
OVOLINA, Terquem, 1866. [= *Lagena*.]
——— **elliptica**, Terquem. Six. Mém. Foram. Lias, 1866, 473, xix, 1.
——— **trigonula**, Terquem. Six. Mém. Foram. Lias, 1866, 473, xix, 2.
OVULIDA, de Folin. Le Naturaliste, Ann. 9, 1887, 114, fig. 8*a*, *b*, *c*. [= ? *Lagena*.]
OVULINA, Ehrenberg, 1854. Mikrogeologie, 1854, pls.
——— **clava**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 2*b*. [= *Lag. clavata*, d'O.]
——— **caudigera**, Seguenza. Foram. monotal. miocen. Messina, 1862, 39, i, 3. [*L. apiculata*, Rss.]
——— **elegantissima**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 316, xii, 1.
——— **lacryma**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 317, xii, 2.
——— **ornata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 42, i, 12. [= *L. squamosa*, Montf.]
——— **ovata**, Schafhäutl. Geogn. Unters. südbayer. Alpengeb. 1851, 48, xiii [misprinted xviii in text], fig. 1, [? an "oolitic granule," not a Foraminifer].
——— **perforata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 40, i, 4. [= *L. apiculata*, Rss.]
——— **radiata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 40, i, 5.
——— **reticulata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 42, i, 11. [= *L. melo*, d'Orb.]
——— **striata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 40, i, 6 and 7. [= *Lagena striata*, d'Orb.]
——— **sulcata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 41, i, 8–10. [= *Lagena sulcata*, W. & J.]
——— **tenuis**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 317, xii, 3, 3*.
OVULINA, Gruber, 1884. Nova Acta k. Leop.-Carol. deutsch. Ak. Nat. XLVI, 1884, 497. [One of the *Difflugiæ*.]
——— **urnula**, Gruber. Nova Acta k. Leop.-Carol. deutsch. Ak. Nat. XLVI, 1884, 497, viii, 19 and 20.
OVULITES, Lamarck, 1812. Extrait Cours Zool. 1812, 26 ; and Hist. Anim. s. Vert. II, 1816, 194 ; Munier-Chalmas, "Siphonées dichotomes," Bull. Soc. géol. France, [3], VII, 1878, 661–670, figs. 1–4 ; [= *Corallio-dendron*, a genus of calcareous Algæ. See Solms-Laubach, Einleit. Palaeophytologie, 1887, 38, etc.].
——— **elongata**, Lamarck. Hist. Anim. s. Vert. II, 1816, 194.

PATELLINA bradyana, Howchin. Journ. R. Microsc. Soc. 1888, 544, ix, 22–25.
——— **campanæformis**, Brady. Report Challenger, 1884, 635, cut, 19*a*, *b*, *c*.
——— **concava** (Lam.). Zittel, Handbuch Palaeont. Abth. I, 1876, 96, fig. 35. [*Orbulites*, 1816.]
——— **concava** (Lam.), var. **lenticularis**, Blumenbach. See *Madreporites*.
——— **corrugata**, Williamson. Recent British Foram. 1858, 46, iii, 86–89.
——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 229, xiii, 16, 17; figs. xxxvii and xxxviii, in text.
——— ——— ——— Parker & Jones, Phil. Trans. 1865, 398, xv, 29*a*, 29*b*, 29*c*.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 31, iv, 3*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 58.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 208, ix, 9.
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 580, xxiv, 8.
——— ——— ——— Brady, Report Challenger, 1884, 634, lxxxvi, 1–7.
——— **dentata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 123, xii (xx), 36, 37.
——— **major**, Hantken. Math. Nat. Ber. Ungarn, III, 1885, 885.
——— **minor**, Hantken. Math. Nat. Ber. Ungarn, III, 1885, 885.
——— **nitida**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 123, xii (xx), 38*a*–*e*.
——— **oolithica**, Terquem. Cinq. Mém. Foram. Oolithique, 1883, 382, xlv, 3*a*, *b*, *c*, and 4.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], IV, 1886, 59, vii, 2–4.
——— **plicata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 72, viii, 9*a*, *b*; (and Mém. Soc. Dunkerquoise). [See *Trochammina*.]
——— **punctata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 128, xvi, 9*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **scutum**, v. Fritsch. Palaeontographica, Supp. III, Lief. 1, 1878, 144, xviii, 15; xix, 2.
——— **simplex**, P. & J. Catal. Foss. Foram. Brit. Mus. 1882, 84. [*Orbitolina*, 1860.]
——— **semiannularis**, P. & J. Catal. Foss. Foram. Brit. Mus. 1882, 84. [*Orbitolina*, 1860.]
——— **trochus**, v. Fritsch. Palaeontographica, Supp. III, Lief. 1, 1878, 145, xviii, 16; xix, 1.
PATROCLES querelans, Montfort. Conch. Syst. I, 1808, 219, 55th genre. [= *Crist. calcar* (*rotulata*).]
PAVONIA. See *Pavonina*, d'Orb.
PAVONINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 260; Brady, Report Challenger, 1884, 374.
——— **flabelliformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 260, x, 10, 11.
——— ——— ——— D'Orbigny, Modèles, No. 56, 1826.
——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. x), 35, xv, 13.
——— ——— ——— Smedley, Ency. Metrop. 1845, n. d., pl. "Mollusca?" 6.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 72, xxi, 9 and 10. [*P. flabelloides* on plate.]
——— [**flabelloides**], ——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 72, vi, 13*a*, *b*.
[**PAVONIA**] ——— ——— P., J., & B. [D'O., Modèles, No. 56], Ann. Mag. Nat. Hist. [3], XVI, 1865, 27, I, 22.
——— [**flabelloides**], ——— Reuss' Models, No. 57, 1865 (Catal., No. 28, 1861).
——— ——— ——— Brady, Q. Journ. Micr. Sci. XIX, 1879, 282, viii, 29, 30.
——— [**flabelloides**], ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 204, viii, 13.
——— ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 91, viii, 13–15.

PENEROPLIS laubei, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 154, iii, 8.

——— **liburnica**, Stache. Abh. k. k. geol. Reichs. XIII, 1889, 89, *va*, 20, 21 (v. *acanthina*) ; 22 (v. *strangulata*) ; 23 (v. *lævigata*) ; 24 (v. *lata*).

——— **lituus** (Gmelin). Brady, Report Challenger, 1884, 205, xiii, 24, 25 (?). [*Nautilus*, 1788.]

——— **opercularis** [Lamarck]. Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 21. [*Renulites*, 1804.]

——— ——— [d'Orb.]. Terquem, Mém. Soc. géol. France, [3], II, 1882, 50, ii (x), 29*a*, *b*.

——— **orbicularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 286, No. 5.

——— **pertusus** (Förskal). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 239, viii, 28. [See *P. planatus* (F. & M.).] [*Nautilus*, 1775.]

——— ——— ——— Nicholson, Manual Palæont. 1879, i, 110, fig. 18*c*.

——— ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 78, iii [numbered iv, by error], 9–12. [Structural.]

——— ——— ——— Jones, in Micrography. Dict. ed. 4, 1883, 584, xxiii, 11*a*, *b*.

——— ——— ——— Brady, Report Challenger, 1884, 204, xiii, 12–25.

——— ——— ——— Bütschli, Morph. Jahrb. XI, 1886, 79, vi, 1–3, 11*a*, *b*. [Sarcode.]

——— ——— ——— Anon., Sci. News, 27 Ap. 1888, 389, fig. 8.

——— ——— ——— Brady, Parker, & Jones, Trans. Zoöl. Soc. XII, pt. 7, 1888, 216, xlii, 18, 19.

[——— ——— ———] Costa, Fauna Regno Napoli, 1838, Foraminiferi, not descr., i, 1–3.

——— ——— ——— See *Nautilus* (*Lituus*) *arietinus*, Batsch.

——— ——— ——— var. **arietinus**, Batsch. See *Nautilus* (*Lituus*).

——— **planatus** (Fichtel & Moll). D'Orbigny, Ann. Sci. Nat. VII, 1826, 285, No. 1. [*Nautilus*, 1798 ; see also *P. lanatus*, Montfort.]

——— ——— ——— D'Orbigny, Modèles, 1826, No. 16, and var., No. 48.

——— ——— [d'Orb.]. Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 9, ii, 9.

——— ——— [d'Orb.]. Cuvier, Animal Kingdom, Henderson's ed., III, 834 (pls. 1837), 18, iii, 9.

——— ——— [d'Orb.]. Cuvier, Règne Animal, 1836–46, IX (pls. X), 33, xv, 2.

——— ——— ——— Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1838, 142, ii, 1. [= *P. pertusus* (Försk.).]

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 202, xxxv^2, 4*a*–*d*.

——— ——— ——— Williamson, Recent British Foram. 1858, 45, iii, 83–85.

——— ——— [Montf.]. Reuss' Models, No. 91, 1865 (Catal., No. 23, 1861).

——— ——— ——— P., J., & B. [D'O., Modèles, 16], Ann. Mag. Nat. Hist. [3], XVI, 1865, 21, i, 17. [= *P. pertusus*, Försk.]

——— ——— ——— P., J., & B. [D'O., Modèles, 48], Ann. Mag. Nat. Hist. [3], XVI, 1865, 26, i, 18. [= *P. arietinus*, Batsch.]

——— ——— ——— var. **lævigata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 153, iii, 7.

——— ——— [Montf.]. Zittel, Handbuch Palaeont., Abth. I, 1876, 79, fig. 13^2.

——— ——— [Montf.]. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl., 108.

——— ——— ——— Schlumberger, F. Jeun. Nat., Jan. 1882, i, 13.

——— ——— ——— Brady, Report Challenger, 1884, 204, xiii, 15.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 162^2, figs.

——— ——— ——— Bütschli, Morph. Jahrb. XI, 1886, 79, vi, 4. [Sarcode.]

——— ——— ——— = *P. pertusus* (Förskal), see *Testæ hammoniformes seu lituitatæ semilunares*.

?——— **polystomatium**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 257.

PERILOCULINA zitteli, Mun.-Ch. & Schlumb. Bull. Soc. géol. France, [3], XIII, 1885, 309, etc., figs. 36–40 ; pl. xiv, 56–59 ; xiv, bis, 69.
PERIPLES elongatus, Montfort. Conch. Syst. I, 1808, 271, 68th genre. [= *Crist. elongata.*]
" Petit fossile ovoïde à côtes de melon." Deluc, v. *Alveolina.*
PETRASCULA, Gümbel, 1873. Sitz. k.-bayer. Ak. Wiss. München, III, 1873, 292. [A calcareous alga ; v. Solms-Laubach, Einleit. Palaeophytologie, 1887, 38, etc., on allied forms.]
——— **bursiformis** (Etallon). Gümbel, Sitz. k.-bayer. Ak. Wiss. München, III, 1873, 292, i, 1–15. [1, 2, and 3, described as v. *læviuscula ;* 4–6, as v. *annulata.*] [See *Conodictyum.*]
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 27, pl., 118.
Pfennigsteine. Schroeter, Journ. Liebh. Steinreich, VI, 1780, 261. [= *Nummulites.*]
Phacites, Gesner, Tract. phys. petrif. 1758, 50. [= *Nummulites.*]
Phacites fossilis, Blumenbach, Abbild. Nat. Gegenstände, Heft 4, No. 40, 1799, pl. 40. [= *Nummulites.*]
Phacolites, Sage, Journ. de Phys. LX, 1805, 222. [= *Nummulites.*]
PHANEROSTOMUM, Ehrenberg, 1841. Abhandl. k. Ak. Wiss. Berlin, 1841, 409.
——— **alloderma**, Ehr. Monatsber. k. preuss. Ak. Wiss. Berlin, 1861, 306.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 12.
——— **asperum**, Ehrenberg. Mikrogeologie, 1854, xxx, 26*a*, *b*, and xxxii, ii, 42. [= *Globig. cretacea.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, i, 24. [= *Globig. hirsuta.*]
——— **atlanticum**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 248.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxv, *B*, iv, 3 and 4. [= *Globig. cretacea.*]
——— **bullaria**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 287.
——— **cribrum**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.
——— **dilatatum**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1855, 176, vii, 16 and 17. [= *Globig. cretacea.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, i, 16 and 30. [= *Globig. hirsuta*, d'O.]
——— **globigerum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 287.
——— **globulosum**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, ii, 44. [= *Globig. cretacea.*]
——— **globulus**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 306.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 14.
——— **hexacyclus**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 31. [= *Globig. hirsuta*, d'O.]
——— **hexaleptum**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 23. [= *Globig. hirsuta.*]
——— **hispidulum**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 22 and 29. [= *Globig. hirsuta.*]
——— ———? ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1855, 176, vii, ii. [= *Globig. cretacea.*]
——— **integerrimum**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1841, 427.
——— **lacerum**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 17 and 18. [= *Globig. hirsuta*, d'O.]
——— **læve**, Ehrenberg. Mikrogeologie, 1854, xxxii, i, 19. [= *Globig. hirsuta*, d'O.]

PHIALINA ornata, Seguenza. Foram. monotal. miocen. Messina, 1862, 48, i, 30. [= *L. squamosa*, Mont.]
——— **ovata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 44, i, 14. [= *L. lævis*, Mont.]
——— **oviformis**, Costa. Atti Accad. Pontaniana, VII, fas. 2 (1856), 123, xi, 8 and 9.
——— **piriformis**, Costa. Atti Accad. Pontaniana, VII, fas. 2 (1856), 123, xi, 6 and 10*a*, *A*.
——— **propinqua**, Seguenza. Foram. monotal. miocen. Messina, 1862, 43, i, 13. [= *L. lævis*, Mont.]
——— **reussana**, Seguenza. Foram. monotal. miocen. Messina, 1862, 48, i, 29. [= *L. sulcata*, W. & J.]
——— **semicostata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 45, i, 19. [= *L. semistriata*, Will.]
——— **tenuistriata**, Seguenza. Foram. monotal. miocen. Messina, 1862, 46, i, 21. [= *L. striata*, d'Orb.]
PHONEMUS, Montfort. Conch. Syst. I, 1808, 11, 3rd genre. [= *Crist.*]
——— Meek, Smithson. Misc. Coll. VII, No. 177 (April, 1864), 1.
[This genus is used by Meek as follows: *Phonemus* (*Cristellaria*) *rotulatus*, d'Orb.? ; *P.* (*Flabellina*) *cuneatus*, (Morton), Meek; *P.* (*Flabellina*) *sagittarius*, (Lea), Meek; *P.* (*Dentalina*) *pulcher*, Gabb.]
" **Phyllitæ Salicitæ seu Iteitæ lapides, vel Silices**," etc. Scheuchzer, Miscell. Curiosa, Acad. Caesar. Leop., dec. III, ann. V and VI, 1697–1698, Appendix, 1700, 63, plate, fig. *I*. [*Nummulites.*]
PHYSOMPHALUS, Ehrenberg, 1855. Abhandl. k. Ak. Wiss. Berlin, 1855, 172. [Glauc.]
——— **porosus**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1855, 172, v, xvi. [Glauc.] [= *Operculina.*]
Piedras lenticulares. } Cavanilles, Obs. Hist. Nat. Valencia, II, 1797, pp. 35,
Piedras numularias. } 183, 188, 199, pl., f. 1*a*, *b*, 2*a*, *b*.
Pierres de Laon. Sage, Journ. de Phys. LX, 1805, 222. [= *Nummulites.*]
Pierres de St. Boniface. Brueckmann. [= *Nummulites.*]
Pierres frumentaires. Guettard, Hist. Acad. Sci. (Paris), 1752, 339. [= *Nummulites.*]
Pierres lenticulaires. Bourguet, Lettres philos. Sels et Crystaux, 1729 [ed. 2, 1762], 171, plate, f. i–iii. [= *Nummulites.*]
Pierres lenticulaires. Denys Dodart, Hist. Acad. Sci. (Paris), I, 1733, 306.
Pierres lenticulaires. L. B***. [Bourguet], Traité des Pétrif., Paris, 1742, 75, l. 321–325, and La Haye, 1742 [Mém. servir l'Hist. Nat. etc., *altered title*], same pl. and figs.
Pierres lenticulaires. Barrere, Observ. Pierres figurées, 1746, 13, figs. *N*, *P*, *P*, *Q*, *Q*. [= *Nummulites.*]
Pierres lenticulaires. Guettard, Mém. diff. part. Sci. II, 1770, 185, etc.; III, 1770, 431, pl. xiii.
Pierres numismales. Bourguet, Lettres philosoph. 1729, 12, fig. 1, 2, and 3. [= *Nummulites.*]
Pierres numismales. Guettard, Mém. diff. part. Sci. etc. II, 1770, 185, etc.; III, 1770, 431, etc., pl. xiii.
Pietra frumentale. Ferranto Imperato, Hist. Nat. Venice, 1672, XXIV, 579, and XXVIII, 664. [= *Nummulites.*]
PILULINA, Carpenter, 1870. Descr. Catal. Obj. Deep-Sea Dredging, no date [1870], 5; Brady, Report Challenger, 1884, 244.
——— **jeffreysii**, Carpenter. The Microscope, ed. 6, 1881, 560, fig. 319* *d*, *e*.
——— ——— ——— Brady, Report Challenger, 1884, 244, xxv, 1–6.
——— ——— ——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 375, 5*d*, *e*.
PINEINA caudata, Schafhäutl. Geogn. Unters. sudbay. Alpengeb. 1851, 49, xiii [misprinted in text, xviii], fig. 19. [An "oolitic granule;" may be *Cristellaria.*]

PLACOPSILINA cornueliana, d'Orb., 1849. Prodrome de Paléont. II, 1850, iii, No. 791. [*Œufs de mollusques*, 1848 = *P. cenomana.*]
——— **cornuta**, Terquem. Six. Mém. Foram. Lias, 1866, 491, xx, 8–21.
——— **costata**, Terquem. Bull. Soc. géol. France, [3], VIII, 1880, 416, xi, 4.
——— **crassa**, Terquem. Six. Mém. Foram. Lias, 1866, 494, xx, 27.
——— **falcata**, Terquem. Cinq. Mém. Foram. Lias, 1866, 422, xvi, 4*a*, *b*.
——— **filipendula**, Terquem. Six. Mém. Foram. Lias, 1866, 492, xx, 22.
——— **flouesti**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 390, vii, 17*a*, *b*.
——— **globata**, Terquem. Six. Mém. Foram. Lias, 1866, 493, xx, 23.
——— **gracilis**, Terquem. Cinq. Mém. Foram. Lias, 1866, 419, xv, 21*a*, *b*, *c*, *d*.
——— ——— ——— Terq. et Berth., Mém. Soc. géol. France, [2], x, 1875, 34, ii (xii), 24*a*, *b*.
——— ——— ——— Schlumberger, F. Jeun. Nat., Jan. 1882, i, 4.
——— **hybrida**, Terquem. Six. Mém. Foram. Lias, 1866, 494, xx, 25 and 26.
——— **irregularis**, Mantell. Wonders Geol. 1857, 7th ed. 335, fig. 65, 2. [See *Webbina.*]
——— ——— ——— Reuss' Models, No. 2, 1865 (Catal., No. 1, 1861). [= *P. cenomana*, d'O.]
——— **kingsleyi**, Siddall. Proc. Lit. Phil. Soc. Liverpool, XL, 1886, Appendix, Fauna Liverpool Bay, 54, i, 1.
——— **longirostrata**, Terquem. Cinq. Mém. Foram. Lias, 1866, 420, xv, 22.
——— **lucida**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 38, i (ix), 43*a*, *b*.
——— **mauritii**, Terquem. Cinq. Mém. Foram. Lias, 1866, 418, xv, 20*a*, *b*.
——— **ovigera**, Terquem. Six. Mém. Foram. Lias, 1866, 495, xx, 30.
——— **polypiarum**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 483, xv, 10 and 11.
——— **prisca**, Terquem. Bull. Soc. géol. France, [3], VIII, 1880, 415, xi, 1*a*, *b*, *c*. [Cast.]
——— **producta**, Terquem. Cinq. Mém. Foram. Lias, 1866, 424, xvi, 7*a*–*h*.
——— **prolifer**, Terquem. Six. Mém. Foram. Lias, 1866, 493, xx, 24.
——— **rostrata** (Quenstedt). Zittel, Handbuch Palæont. I, 1876, 76, fig. 8^3. [*Bullopora*, 1858.]
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 12.
——— **rotaliformis**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 18, i, 3–3*c*.
——— ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [15], i, 12, 12*a*.
——— **rhyzomorpha**, Terquem. Cinq. Mém. Foram. Lias, 1866, 422, xvi, 3*a*–*f*.
——— **scorpionis**, d'Orbigny. Prodrome de Paléont. I, 1849, 259, No. 283. [See also *Webbina.*]
——— ——— ——— Terquem, Cinq. Mém. Foram. Lias, 1866, 421, xvi, 2*a*–*e*.
——— **serpentina**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 391, vii, 18*a*, *b*.
——— **vermicularis**, Terquem. Six. Mém. Foram. Lias, 1866, 496, xx, 31.
——— **vesicularis**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 51, v, 2.
——— ——— ——— Brady, Report Challenger, 1884, 316, xxxv, 18 and 19.
——— **vetusta**, Terquem. Bull. Soc. géol. France, [3], VIII, 1880, 416, xi, 3. [Cast.]
——— **vitrea**, Seguenza. Atti R. Acc. Lincei, [3], XII, 1882, 198, xxi, 1, 1*a*, 1*b*.
——— see *Œufs*.

PLANISPIRINA, Seguenza, 1880. Atti R. Acc. Lincei, [3], VI, 1880, 310; Brady, Report Challenger, 1884, 193.
——— **carinata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 310, xvii, 19.
——— **celata** (Costa). Brady, Report Challenger, 1884, 197, viii, 1–4. [*Spiroloculina*, 1855.]
——— ——— ——— Schlumberger, Bull. Soc. zool. France, XII, 1887, iii, vii, 12–14; woodcuts, figs. 6, 7.
——— **communis**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 310, xvii, 18, 18*a*.

PLANORBULINA crenulata (Reuss). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 90.
——— **culter**, Parker & Jones. Phil. Trans. 1865, 421, xix, 1. [See *Truncatulina.*]
——— **difformis**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 390, iii, 59.
——— **distoma**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 73, viii, 11 (and Mém. Soc. Dunkerquoise).
——— **dutemplei**, d'Orb. Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 202, ii, 49. [*Rotalina*, 1846.]
——— **echinata**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 283, viii, 31*a*, *b*, *c*. [See *Truncatulina.*]
——— **eocænica**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 90, ix (xvii), 15*a*, *b*.
——— **exsculpta** (Reuss). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 90. [*Rotalia*, 1860.]
——— **farcta** (Fichtel & Moll). See *Nautilus*, 1798.
——— ——— ——— var. **reticulata**, Czizek. Parker & Jones, Ann. Mag. Nat. Hist. [3], XI, 1863, 92, cut in text, fig. 3. [*Rotalina*, 1848.]
——— ——— ——— (varieties). Parker & Jones, Phil. Trans. 1865, 378, xiv, 3–11 ; xvi, 18–25.
——— ——— ——— var. (**Anomalina**) **coronata**, P. & J. Phil. Trans. 1865, 383, xiv, 7–11. [*Anomalina*, 1857.]
——— ——— ——— var. **haidingerii** (d'O.). Parker & Jones, Phil. Trans. 1865, 382, xvi, 22*a*, 22*b*. [*Rotalina*, 1846.]
——— ——— ——— var. (**Truncat.**) **lobatula** (W. & J.) Parker & Jones, Phil. Trans. 1865, 381, xiv, 3–6 ; xvi, 18–20. [See *Truncatulina.*]
——— ——— ——— var. **mediterranensis**, d'O. Parker & Jones, Phil. Trans. 1865, 383, xvi, 21. [See *P. mediterranensis.*]
——— ——— ——— var. **ungeriana** (d'O.). Parker & Jones, Phil. Trans. 1865, 382, xvi, 23–25. [*Rotalina*, 1846.]
——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 95, vii, 220–225.
——— ——— ——— var. **vulgaris**, d'Orb. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 97, vii, 226 and 227. [See *P. vulgaris.*]
——— ——— ——— Jones, Quart. Journ. Geol. Soc. XL, 1884, 770, xxxiv, 16.
——— ——— See *Polyxenes.*
——— **flabellum**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 92, ix (xvii), 19.
——— **galiciana** (Alth). Olszewski, Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 124, ii, 2*a*, *b*, *c*, *d*. [*Rosalina*, 1850.]
——— **globulosa**, Ehr. Malagoli, Atti Soc. Nat. Modena, (Rend.), [3], III, 1887, 110, i, 13.
——— **haidingeri** (d'Orb.). Brady, Trans. Linnean Soc. XXIV, 1864, 469, xlviii, ii. [*Rotalina*, 1846.]
——— ——— ——— J., P., & B., Crag. Foram., Pal. Soc. XIX, 1866, n. d., iv, 18.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 202, ii, 48.
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 605, xxiv, 6*a*, *b*.
——— ——— ——— and var., d'O. Jones, Quart. Journ. Geol. Soc. XL, 1884, 770, xxxiv, 14 and 15.
——— ——— ——— var. Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 757, xvi, 17*a*, *b*.
——— ——— ——— See *Planorb. farcta* (F. & M.).
——— **inflata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 74, viii, 12 (and Mém. Soc. Dunkerquoise).
——— **kahlembergensis** (Rss.). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 53. [*Rotalina*, 1846.]
——— **larvata**, Parker & Jones. Phil. Trans. 1865, 380, xix, 3*a*, *b*. [*P. vulgaris*, var. 1860.]

PLANORBULINA larvata, Parker & Jones. Carter, Ann. Mag. Nat. Hist. [4], xix, 1877, 214, xiii, 16.

—— —— —— Brady, Report Challenger, 1884, 658, xcii, 5 and 6.

—— **lenticula**, Reuss. In Geinitz, Palaeontographica, xx, Th. 2, 1874, 115, xxiii, 11. [See *Rotalina.*]

—— **longiscuta**, Terquem. Mém. Soc. géol. France, [3], i, 1878, 23, ii (vii), 5.

—— **lorneiana** (d'Orb.). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 12. [*Rosalina*, 1840.]

—— **mediterranensis**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 280, No. 2, xiv [v in text, by error], 4–6 bis.

—— —— —— D'Orbigny, Modèles, No. 79, 1826.

—— —— —— D'Orbigny, Foram. Fossiles Vienne, 1816, 166, ix, 15–17.

—— ——? —— Pilla, Distinz. terr. Etrurio, 1846, 104, i, 7. [= *Rotalia beccarii.*]

—— —— —— Costa, Atti Accad. Pontaniana, vii, fas. 2, 1856, 244, xxi [error for xx], 7.

—— —— —— Reuss' Models, No. 79, 1865 (Catal., No. 90, 1861).

—— —— —— P., J., & B. [d'O., Modèles, No. 79], Ann. Mag. Nat. Hist. [3], xvi, 1865, 31, ii, 74.

—— —— —— J., P., & B., Crag Foram., Pal. Soc. xix, 1866, n. d., ii, 3.

—— —— —— Anon., Science Gossip, 1870, 10, fig. 21.

—— —— —— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], viii, 1871, 178, xii, 133.

—— —— ——? *Idem*, 179, xii, 134. [See *Soldania nitida*, d'O.] [A fragment.]

—— —— —— Zittel, Handbuch Palaeont. i, 1876, 93, fig. 30[1].

—— —— —— Schwager, Boll. R. Com. Geol. Ital. viii, 1877, 26, pl., 55.

—— [——] —— K. Miller, Schr. Ver. Gesch. Bodensee, vii, 1877 [78], iv, 25. [Cast or concretion ?]

—— —— —— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 206, ix, 8.

—— —— —— Jones, in Microgr. Dict. ed. 4, 1883, 605, xxiv, 10.

—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, xxxv, 1883, 194, iii, 38.

—— —— —— Brady, Report Challenger, 1884, 656, xcii, 1–3.

—— —— —— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 162, fig.

—— —— —— Quenstedt, Handbuch Petref. ed. 3, 5 (1885), 1058, lxxxvi, 50.

—— —— —— Brady, Parker, & Jones, Trans. Zool. Soc. xii, pt. 7, 1888, 227, xlv, 18.

[—— —— ——] Costa, Fauna Regno Napoli, 1838, Foraminiferi, n. d., i, 6 and 7.

—— —— —— See *Corpuscula*, etc.

—— —— —— See *P. farcta* (F. & M.).

—— **megastoma**, Terquem. Mém. Soc. géol. France, [3], i, 1878, 23, ii (vii), 3*a*–4.

—— **nitida**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 280, No. 1.

—— —— —— D'Orbigny, Modèles, 1826, No. 78.

—— —— —— P., J., & B. [d'O., Modèles, No. 78], Ann. Mag. Nat. Hist. [3], xvi, 1865, 31, ii, 75.

—— —— —— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 162, fig.

—— **nodosa**, Terquem. Mém. Soc. géol. France, [3], ii, 1882, 91, ix (xvii), 16.

—— **planissima**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. iv, Heft 1, 1884, 55, ii, 21 and 21*a*.

—— **polyrraphes**, Reuss. In Geinitz, Palaeontographica, xx, Th. 2, 1874, 114, xxiii, 10. [*Rotalina*, 1845.]

PLANORBULINA punctata, Terquem. Mém. Soc. géol. France, [3], II, 1882, 91, ix (xvii), 17.
——— **radiata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 74, viii, 13 ; (and Mém. Soc. Dunkerquoise).
——— **reticulata** (Czj.). Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 103, vii, 242–244. [*Rotalina*, 1848.]
——— **retinaculata**, Parker & Jones. Phil. Trans. 1865, 380, xix, 2.
——— **reussi**, Uhlig. Mojsisovics und Neumayr's Beiträge Pal. Oest-Ungarn, I, 1882, 181, xvi, 3.
——— **rosea** (d'Orb.). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 24. [*Rotalina*, 1839.]
——— **rotula** (d'Orb.). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 177, xii, 131. [v. also *Planulina ariminensis*, d'O.]. [*Anomalina*, 1846.]
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 204, iii, 52.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 757, cut in text No. 155.
——— ——— ——— Malagoli, Atti Soc. Nat. Modena (Rend.), 3, III, 1887, 110, i, 12.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 116, vii, 4.
——— **rubra**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 280, No. 4.
——— **soldanii** (d'Orbigny). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 178, xii, 132. [*Planulina*, 1826.]
——— **tuberosa** (Fichtel & Moll). v. *Nautilus*, 1798.
——— ——— ——— var. **ariminensis**, d'Orb. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 98, vii, 228–233. [*Planulina*, 1826.]
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 196, iii, 39.
——— **truncata**, Egger. Neues Jahrbuch, 1857, 280, x, 15–17.
——— **umbilicata**, v. Hagenow. Neues Jahrbuch, 1842, 572.
——— **umbilicata** (d'Orb.). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 246, xii, 135. [*Nonionina*, 1826.]
——— **ungeriana** (d'Orb.). Brady, Trans. Linnean Soc. XXIV, 1864, 469, xlviii, 12. [*Rotalina*, 1846.]
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——— ——— ——— v. **affixa**, Goës. K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 103, vii, 237–241.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 757, xvi, 16*a–c*.
——— ——— ——— See *P. farcta* (F. & M.).
——— **veneta**, Jones. In Micr897 Dict. ed. 4, 1883, 605, xxiv, 12.
——— **vermiculata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 280, No. 3. [v. *Pulvinulina*.]
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——— **vicinalis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 90, ix (xvii), 14.
——— **voltziana** (d'Orb.). Jones, Catal. Foss. Foram. Brit. Mus. 1882, 88. [*Rotalina*, 1840.]
——— **vulgaris**, d'Orbigny. Barker-Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 134, ii, 30.

PLANULARIA costata, Cornuel. Mém. Soc. géol. France, [2], III, 1848, 253, ii, 5-8.
——— **crepidula** (F. & M.). = *Cristellaria*, q. v., and *Nautili lituitati*.
——— **crepidularis**, Roemer. Neues Jahrbuch, 1842, 273, vii, *B*, 4. [v. *Cristellaria.*]
——— **cuneata**, Morton. Journ. Ac. Nat. Sci. Philad. VIII, 1839, 214, xi, 5.
——— **cymba**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 260, No. 4, x, 9.
——— ——— ——— D'Orbigny, Modèles, 1826, No. 27.
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——— ——— ——— P., J., & B. [d'O., Modèles, No. 27], Ann. Mag. Nat. Hist. [3], xvi, 1865, 23, i, 38.
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——— **denticulata**, Reuss. Geogn. Skizze Böhmen, II, 1844, pt. 1, 211.
——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 259, No. 2. [v. also *Vaginulina.*]
——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 259, No. 1. [v. also *Vaginulina.*]
——— **elongata**, Ehr. Mikrogeologie, 1854, xxxii, ii, 10. [= *Crist. crepidula* (F. & M.).]
——— **exilis**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.
——— **falcata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 141, xiii, 17.
——— **harpula** (d'Orb.). Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865-66 (1867), 227, iii, 34 and 35. [*Marginulina*, 1849.]
——— **intermedia**, Philippi. Tertiär. nordwest. Deutsch. 1843, 40, i, 38. [v. *Cristellaria.*]
——— **lævis**, Ehr. Abh. k. Ak. Wiss. Berlin, 1838, 132.
——— **lævis**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 141, xiii, 16 and 16*a*.
——— **longa**, Cornuel. Mém. Soc. géol. France, [2], III, 1848, 252, i, 38 and 39.
——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865-66 (1867), 226, ii, 27.
——— **matutina**, d'O. Terquem, Mém. Ac. Imp. Metz, XXXIX, 1858, 619, iii, 14*a*–*c*.
——— **nodosa**, v. Hagenow. Neues Jahrbuch, 1842, 569, ix, 21.
——— **oblonga**, Philippi. Tertiär. nordwest. Deutsch. 1843, 41, not figured.
——— **orbiculata**, Roemer. Neues Jahrbuch, 1842, 273, vii, B, 6.
——— **pauperata**, Jones & Parker. Quart. Journ. Geol. Soc. XVI, 1860, 454, xx, 39. [v. *Cristellaria.*]
——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865-66 (1867), 226, ii, 24, 25 (and 26?).
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 27.
? ——— **pelagi**, Ehr. Abh. k. Ak. Wiss. Berlin, 1841, 427, iii, vii, 43. [= *Pulv. auricula?* (F. & M.).]
——— **reticulata**, Cornuel. Mém. Soc. géol. France, [2], III, 1848, 253, ii, 1-4.
——— ——— ——— Jones & Parker, Quart. Journ. Geol. Soc. XVI, 1860, xx, 38.
——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865-66 (1867), 227, ii, 31-33.
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxix, 14.
——— **rostrata**, d'Orb. Ann. Sci. Nat. VII, 1826, 260, No. 7.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 166, x, 75.
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxix, 16.
——— ——— ——— See *Nautili lituitati cuspides*. [= *Cristellaria.*]
——— **semicircularis**, Philippi. Tertiär. nordwest. Deutsch. 1843, 41, i, 39. [v. *Cristellaria.*]
——— **striata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 259, No. 3. [v. also *Vaginulina.*]

PLANULARIA tenella, Ehr. Mikrogeologie, 1854, xxix, 41. [= *Cristellaria.*]

——— **thebaica**, Ehr. Mikrogeologie, 1854, xxiv, 63. [= *Crist. italica ?*]

PLANULARIA, Nilsson. K. Vet. Ak. Handl. 1825 (1826), 342 ; and Petrif. Suecana, 1827, 10. [= *Frondicularia.*]

——— **angusta**, Nilsson. K. Vet. Ak. Handl. 1825 (1826), 343. [v. also *Frondicularia.*]

——— ——— ——— Nilsson, Petrif. Suecana, 1827, 11, ix, 22*a*, *A*.

——— ——— ——— Hisinger, Lethaea Svecica, 1837, 33, viii, 4.

——— **elliptica**, Nilsson. K. Vetensk. Acad. Handl. for 1825 (1826), 342. [v. *Flabellina ;* also *Frondicularia.*]

——— ——— ——— Nilsson, Petrif. Suecana, 1827, 11, ix, 21*a*, *A*.

——— ——— ——— Hisinger, Lethaea Svecica, 1837, 33, viii, 3.

PLANULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, p. 280.

——— **abyssicola**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 307.

——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 15.

——— **adspersa**, Ehrenberg. Mikrogeologie, 1854, xx, ii, 20. [= *Planorbulina.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxviii, 48. [= *Crist. ? rotulata* vel *cultrata.*]

——— **æthiops**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 132.

——— **ammonis**, Ehrenberg. Mikrogeologie, 1854, xxiv, 55. [= *Planorb. ammonoides.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxvii, iv, 3. [= *Operculina*, compare *O. sublævis*, Gümb., 1868.]

——— ——— ——— Kübler & Zwingli, Neujahrsblatt Burgersbibl. Winterthur, 1866, 18, iii, 22. [= *Planorbulina.*]

———? **ampla**, Ehrenberg. Mikrogeologie, 1854, xxiii, 48. [= *Crist. cultrata.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 44 and 45. [= *Planorb. ammonoides.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 61. [Near *P. ariminensis.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxix, 13. [*Pulvin. elegans* group.]

——— **ampliata**, Ehrenberg. Mikrogeologie, 1854, xxxi, 60. [Near *P. ariminensis.*]

? ——— ——— ——— Ehr., Mikrogeologie, 1854, xxiii, 50. [= *Crist. cultrata.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxiv, 54 and 60 ? ; xxv, ii, *B*, 11 ; xxvii, 47 ; and xxx, 33. [= *Planorb. ammonoides.*]

——— **angusta**, Ehrenberg. Mikrogeologie, 1854, xxix, 14. [*Pulvin. elegans*, group.]

——— **angusta**, Ehrenberg. Mikrogeologie, 1854, xxvi, 46, and xxxvii, 41. [= *Planorb. ammonoides.*]

——— **annulosa**, Ehrenberg. Mikrogeologie, 1854, xxviii, 44. [= *Cristellaria.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 42*a*, *b*, and xxx, 29. [= *Planorb. ammonoides.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xx, i, 56. [= *Pl. ariminensis ?* or *Nonionina ?*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xx, ii, 21*b*. [= *Planorbulina.*]

? ——— **apiculata**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.

——— **areolata**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.

——— **argulus**, Ehrenberg. Mikrogeologie, 1854, xxvi, 32. [= *Planorb. globulosa.*]

——— **argus**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.

——— ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1843, 257.

PLANULINA argus, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 32. [= *Planorb. farcta.*]

——— **ariminensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 280, No. 1, xiv [v in text], 1–3 bis. [*arminensis* in text.] [v. *Planorbulina*, and *P. tuberosa*, var.]

——— ——— ——— D'Orbigny, Modèles, No. 49, 1826.

——— ——— ——— Smedley, Ency. Metrop. 1845, undescr. pl. "Mollusca"? 7 and 8.

——— ——— ——— Cuvier, Règne Animal, 1836–46, ix (pls. x), 34, xv, 7.

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 677, xxiv, 45.

——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 201, fig. xxxii, *F.*

——— ——— ——— P., J., & B. [D'O., Modèles, 49], Ann. Mag. Nat. Hist. [3], XVI, 1865, 26, iii, 78. [= *Planorbulina.*]

——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 51.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (85), 162, fig.

——— ——— ——— = *Planorb. rotula* (d'O.), v. *Ammoniæ foliaceæ*, and *Hammoniæ subrotundæ.*

——— **aspera**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.

——— ——— ——— Ehr., Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 288.

——— **baileyi**, Ehr., v. *Aristerospira.*

——— **caspia**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), xii, 7.

——— **centoculus**, Ehrenberg. Mikrogeologie, 1854, xxiv, 45. [= *Planorb. vulgaris.*]

——— **chloës**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 288.

? ——— **conspersa**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.

——— **cornu**, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 46. [= *Planorb. ariminensis.*]

? ——— **crisiæ**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 23.

? ——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 18.

? ——— **cymodoceæ**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 24.

? ——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 19.

——— **decrescens**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 288.

——— **denticulata**, Ehrenberg. Mikrogeologie, 1854, xx, ii, 18. [= *Planorb. farcta.*]

——— **depressa**, Ehrenberg. Mikrogeologie, 1854, xxiv, 48. [= *Planorb. ungeriana ?*]

——— ——— ——— Ehr., Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 307.

——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 20.

——— **diaphana**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1373), v, 10.

——— **dubia**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 280, No. 2. [v. also *Platulina.*]

[**PLATULINA**] **dubia**, d'Orb. Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 9, ii, 10.

? ——— **elegans**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.

——— ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1844, 93 ; and Mikrogeologie, 1854, xix, 93. [= *Planorbulina haidingeri.*]

——— ——— ——— Hopkins, Execut. Doc. 45 Congress, Sess. 3, IV, Rpt. Chief Engineers, pt. 2, App. W, 1878, 79, 885, ii, 66.

——— {**erosa** / **porosa**}, Ehrenberg. Mikrogeologie, 1854, xxxv, *A*, iv, *B*, i. [= *Globig. bulloides.*]

PLANULINA incurva, Ehrenberg. Mikrogeologie, 1854, xxiii, 36. [= *P. ariminensis.*]
——— **incurvata**, Ehrenberg. Mikrogeologie, 1854, xxvi, 42. [= *Pulvin. menardii.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 52. [= *Globig. cretacea.*]
——— **integra**, Ehrenberg. Mikrogeologie, 1854, xxiv, 56, 57 and 61. [= *Planorbulinæ.*]
? ——— **involuta**, Ehrenberg. Mikrogeologie, 1854, xxiii, 49. [= *Crist. cultrata.*]
——— **isidis**, Ehrenberg. Mikrogeologie, 1854, xxiii, 31. [= ? *Globigerina.*]
——— **lævigata**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 307.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 10.
——— **leiopentas**, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 37. [v. *Aristerospira ;* = *Planorbulina.*]
——— ———? ——— Ehr., Mikrogeologie, 1854, xxvi, 37. [= ? *Planorb.* near *haidingeri.*]
——— **lenticula**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133.
——— **lenticulina**? Ehrenberg. Mikrogeologie, 1854, xxiii, 42 and 43. [= *Planorbulinæ.*]
——— **leptoderma**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 307.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 8.
——— **leptostigma**, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 44 and 47. [= *Planorb. ariminensis.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 43. [= *Planorb. ammonoides.*]
——— **libyca**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133.
——— **lugubris**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 372.
——— **marmorata**, Ehrenberg. Mikrogeologie, 1854, xxvi, 51. [= *Crist. rotulata.*]
——— **mauryana**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 289.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), iii, 1.
——— **megalopentas**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 289.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 7.
——— **megapora**, Ehrenberg. Mikrogeologie, 1854, xxiv, 46. [= *Planorb. vulgaris.*]
——— **membranacea**, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 41. [= *Pulv. karsteni.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvi, 43. [= *Pulvin. menardii* (d'O.).]
——— **mesolia**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 25.
——— **mica**? Ehrenberg. Mikrogeologie, 1854, xxxvi, 67. [= *Planorbulina.*]
——— **micromphala**, Ehrenberg. Mikrogeologie, 1854, xxvii, 38–40. "= *Pl. turgida*, 1838, in part." [= *Planorb. ammonoides.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvi, 47. [= *Planorb. ammonoides.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 59. [Near *Plan. ariminensis.*]
——— ———? ——— Ehr., Mikrogeologie, 1854, xxvi, 50. [= *Crist. rotulata.*]
——— ———? ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1855, 162, ii, ix. [= *Rotalia beccarii.*] [Glauc.]
——— **micropentas**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 289.

PLANULINA pomerana, Ehrenberg. Mikrogeologie, 1854, xxx, 30. [= *Pulvin. micheliniana.*]
——— **porophæna**, Ehrenberg. Mikrogeologie, 1854, xxxi, 56. [= *P. ariminensis.*]
——— **porosa**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 68; and Mikrogeologie, 1854, xx, ii, 19. [v. *Aristerospira*; = *Planorb. farcta.*]
——— ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1844, 94; and Mikrogeologie, 1854, xix, 95. [= *Planorb. haidingeri*, limbate var.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxiv, 44. [= *Planorb. haidingeri.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvi, 39 and 40. ("*Rosalina lævigata*, 1838, in part.") [= *Planorb. haidingeri*, subvar.]
——— ——— ——— Ehr., Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 308.
——— **porosior**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), xii, 1.
——— **profunda**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, p. 290.
——— ——— ——— Ehr., in Koldewey, Zweite Deutsche Nordpolarfahrt, 1874, ii, n. d. i, 17 and 18.
——— **prorotetras**, Ehrenberg. Mikrogeologie, 1854, xxiv, 50. [= *Planorb. tuberosa*, F. & M.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xx, ii, 16. [= *Glob. bulloides.*]
——— **pyramidum**, Ehrenberg. Abh. k. preuss. Ak. Wiss. Berlin, 1838, 133.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxiii, 38. [= *Opercul. complanata.*]
——— **quaternaria**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 373.
——— **saxipara**, Ehrenberg. Mikrogeologie, 1854, xxv, i, *A*, 36. [= *Planorbulina.*]
——— **scutata**, see *Aristerospira.*
——— **septenaria**, Ehrenberg. Mikrogeologie, 1854, xxv, ii, *B*, 10. [= *Planorb. vulgaris.*]
——— **seriata**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 9.
? ——— **sicula**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133, iv, ii, iii.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvi, 48 and 49. [48 = *Rotalia?* 49 = *Planorbulina?*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxix, ii. [Near *P. ariminensis.*]
——— **soldanii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 280, No. 4. [v. *Planorbulina.*]
——— ——— ——— = *Planorbulina*; see *Hammoniæ subrotundæ*; and *H. planæ rotundæ.*
——— **sparsipora**, Ehrenberg. Mikrogeologie, 1854, xx, ii, 22. [= *Rotalia orbicularis.*]
——— **spatiosa**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 94; and Mikrogeologie, 1854, xxi, 95 [xxix, 15; xxx, 28 (near)]. [Near var. *pulchella* of *Pulv. repanda.*]
——— **speciosa**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133.
——— **spira**, Ehrenberg. Mikrogeologie, 1854, xxvi, 52. [= ? *Planorbulina.*]
——— **sphærocharis**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, p. 290.
——— ——— ——— Ehr., Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 9.
——— **splendida**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133.
——— **spongarium**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 26.
——— **squamula**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 67 and 94; and Mikrogeologie, 1854, xxi, 94. [= *Planorbulina*, limbate var.]
——— **stellaris**, Ehrenberg. Mikrogeologie, 1854, xx, ii, 23. [= *Planorb. haidingeri.*]

PLECANIUM concavum, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 129, i, 3. [v. *Textularia.*]
——— **costatum**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 151, xiv, 8*a*, *b*.
——— **cretaceum**, Dunikowski. Kosmos [Lemberg], IV, 1879, 130, plate, 25.
——— **depravatum**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 93, ii, 3.
——— **depressum**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 134, ii, 8.
——— **elegans**, Hantken. Magyar. Földt. Társ. Munkálatai, IV, 1868, 83, i, 5*a*, *b*.
——— **eocænum**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 603, i, 3 bis, *a*, *b*.
——— **eurystoma**, Stache. Novara-Exped., Geol. Theil I, 1864, 179, xxi, 19*a*, *b*.
——— **fœdum**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 165, i, 3.
——— **gibbosum** [d'Orb.].* Zittel, Handbuch Palaeont., Abth. 1, 1876, 66, fig. 4^2, and 89, fig. 26. [On p. 89 given as *P. gibbum*, d'Orb.] [*Textularia*, 1826.]
——— ——— [Reuss.].* Hoernes, Elem. Palaeont. 1884, 33, fig. 26 ; French ed. 1886, same fig.
——— **granosissimum**, Stache. Novara-Exped., Geol. Theil I, 1864, 179, xxi, 18*a*, *b*.
——— **granuliferum**, Gümbel. Sitz. k.-bay. Ak. Wiss. III, 1873, 39, no fig.
——— **irregulare**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 151, xiv, 9*a*, *b*. [Error for 7.]
——— **karreri**, Stache. Novara-Exped., Geol. Theil I, 1864, 178, xxi, 17*a*, *b*.
——— **labiatum**, Reuss. Bull. Ac. Roy. Belge, [2], XV, 1863, 139. [*Textilaria*, 1860.]
——— **lanceolatum**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 129, i, 2.
——— **laxatum**, Schwager. Novara-Exped., Geol. Theil II, 1866, 195, iv, 5*a*, *b*.
——— **ligulatum**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 115, xxvi (3), 15*a–c*.
——— **lythostrotum**, Schwager. Novara-Exped., Geol. Theil II, 1866, 194, iv, 4*a*, *b*, *c*.
——— **mariæ** (d'O.), v. **inermis**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 64, i, 5–7.
——— ——— ——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer Ak. Wiss. X, 1868 (1870), 603, i, 3 ter. *a*, *b*.
——— **niloticum**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 115, xxiv (3), 14*a–c*.
——— **partschi**, Reuss. In Geinitz, Palaeontographica, XX, Th. 2, 1874, 126, xxiv, 13. [*Textilaria*, 1860.]
——— **roscidum**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 165, i, 2.
——— **rugosum**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 453, i, 3*a*, *b*. [v. *Textularia.*]
——— **scharrachbergense**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 296, vi, 16.
——— **serratum**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 66, i, 4*a*, *b*.
——— **solitum**, Schwager. Novara-Exped., Geol. Theil II, 1866, 195, iv, 6*a*, *b*, *c*.
——— **speyeri**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 449, i, 3.
——— **spinulosum**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 65, i, 3*a*, *b*.
——— **sturi**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 703, i, 1.

* Zittel's & Hoernes' figures are the same. They are evidently meant for, but they differ very much from, *Text. gibbosa*, d'Orb., Ann. Sci. Nat., and Modèles, 1826.

PLEUROSTOMELLA fusiformis, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 205, viii, 1.

——— ——— ——— Reuss' Models, No. 31, 1865 (Catal., No. 58, 1861). [= an extreme form of *Virgulina*.]

——— **incrassata**, Hantken. Ertek. termesz. köreböl, XIII, No. 1, 1883, 25, i, 4*a*, *b*; 7*a*, *b*; and Math. Nat. Ber. Ungarn, II, 1884, 146.

——— **obtusa**, Berthelin. Mém. Soc. géol. France, [3], I, 1880, 29, i (xxiv), 9*a*, *b*.

——— **rapa**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 630, i, 54.

——— ——— ——— Brady, Report Challenger, 1884, 411, li, 21*a*, *b*.

——— **reussi**, Berthelin. Mém. Soc. géol. France, [3], I, 1880, 28, i (xxiv), 10*a*–12.

——— **subnodosa**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 204, viii, 2*a*, *b*. [*Nodos. nodosa*, 1845; *Dental. subnodosa*, 1850.]

——— ——— ——— Brady, Report Challenger, 1884, 412, lii, 12 and 13.

——— **tenuis**, Hantken. Ertek. termesz. köreböl, XIII, No. 1, 1883, 25, i, 5*a*, *b*; and Math. Nat. Ber. Ungarn, II, 1884, 145. [Omitted in explan. to plate.]

PLEUROSTOMINA, Costa, 1862. Annuario Mus. Zool. Univ. Napoli, I, 1862, Art. 11, 94. [Conchiglia libera, inequilatere, compressa, con tre concameragioni visibili allo esterno, delle quali una occupa per intero una delle facce, e le altre due la faccia opposta. Apertura piaggata su quest' ultima in fondo ad una cavità posta nella parte superiore della concameragione più angusta.]

——— **bimucronata**, Costa. Ann. Mus. Zool. Univ. Napoli, I, 1862, Art. 11, 94, no figure.

PLEUROTREMA calcarina, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1838, 133.

PLICATILIA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1. [A family group name.]

Pœcilospermos, Mercatus, Metallotheca, 1719, 285, fig., and 286, fig. [= *Nummulites*.]

Polimorphina, Hantken, 1875. Misprint for *Polymorphina*.

POLLONTES vesicularis, Montfort. Conch. syst. I, 1808, 247, 62d genre. [= *Miliol. seminulum*.]

——— ——— ——— Bowdich, Elem. Conch. Part 1, 1822, 16, iii, 16. [*Miliolina*, striated.]

POLYMORPHA globulifera, Soldani. Testac. I, pt. 2, 1791, p. 119, pl. 130*pp*, *qq*, *rr*. [*Globigerina helicina*, d'O. Ann. Sci. Nat. VII, 1826, p. 277, 5.]

——— **janiformia**, Sold. Testac. II, 1798, 39, pl. 14*h*. [*Textularia tuberosa*, d'O. Ann. Sci. Nat. VII, 1826, p. 263, 26.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 119, pl. 132*I*, *K*. [*Textularia gibbosa*, d'O. Ann. Sci. Nat. VII, 1826, p. 262, 6.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 119, pl. 132*L*, *M*. [*Textularia lævigata*, d'O. Ann. Sci. Nat. VII, 1826, p. 262, 4.]

——— **pineiformia**, Sold. Testac. I, pt. 2, 1791, p. 118, pl. 127*H*. [*Textularia obtusa*, d'O. Ann. Sci. Nat. VII, 1826, p. 262, 1.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 118, pl. 127*I*, pl. 130*vv*. [*Bulimina aculeata*, d'O. Ann. Sci. Nat. VII, 1826, p. 269, 7.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 119, pl. 130*ss*, *tt*. [*Uvigerina pygmæa*, d'O. Ann. Sci. Nat. VII, 1826, p. 269, 2.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 118, pl. 126*xx*, *yy*, *zz*, *A*, *B*. [*Uvigerina nodosa*, d'O. Ann. Sci. Nat. VII, 1826, p. 269, 3.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 118, pl. 127*C*. [*Nod. sulcata*, d'O. Ann. Sci. Nat. VII, 1826, p. 253, 21.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 119, pl. 131*xx*. [*Bulimina trilobata*, d'O. Ann. Sci. Nat. VII, 1826, p. 269, 6.]

——— ——— ——— Sold., Testac. I, pt. 2, 1791, p. 118, pl. 127*K*. [*Textularia echinata*, d'O. Ann. Sci. Nat. VII, 1826, p. 263, 24.]

POLYMORPHINA amygdala, Terquem. Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [37], i, 20 and 20*a*.
——— **amygdaloides**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 250, viii, 84. [*Globulina*, 1851.]
——— ——— ——— Brady, Report Challenger, 1884, 560, lxxi, 13.
——— **amygdaloides**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 39, iii (viii), 22*a*–30.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 141, xiv (xxii), 30 and 31.
——— **anceps**, Philippi. Tertiär. nordwest. Deutsch. 1843, 41 and 70, i, 34.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 246, vi, 68; vii, 69.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 472, iv, 2 and 3 [iii, 11 and 12 and iv; 1, also quoted = *P. regularis*].
——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 155, iv, 9–11.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 223, xxxix, 8*a*–*c*.
——— ——— ——— Steinmann, Elem. Paleont. I, 1888, 28, fig. 9.
——— **annulata**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 304, xxxiii, 5 and 6.
——— (**Glob.**) **angusta**, Egger. Neues Jahrbuch, 1857, 290, xiii, 13–15.
——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 210, ix, 17.
——— ——— ——— Brady, Report Challenger, 1884, 563, lxxii, 1–3.
——— **angustata**, Terquem. Quatr. Mém. Foram. Lias, 1864, 296, xii, 33–35.
——— **applanata**, K. Miller. Schr. Ver. Gesch. Bodensee, Heft VII, 1877, [77], iv, 18. [Cast or concretion ?].
——— **appula**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 286 [282], xviii, 17*a*, *A*, *B*.
? ——— **armata**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, p. 373.
——— **aristophanis**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 26.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 1.
——— **asparagus**, Ehr. Mikrogeologie, 1854, xxvii, 14; and xxix, 31. [= *Virg. squamosa.*]
——— ——— ——— Kübler & Zwingli, Neujahrsblatt Burgersbibl. Winterthur, 1866, 19, iii, 18. [= *Virgulina.*]
——— **aspera**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 291.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 13.
——— **asperella**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 385, xvi*b*, 47.
——— **asummata**, (Will.). Robertson, Trans. Edin. Geol. Soc. IV, 1883, 144. [Error for *acuminata.*]
——— **australis**, (d'O.). B., P., & J., Trans. Linn. Soc. XXVII, 1870, 239, xli, 27*a*, *b*. [*Globulina*, 1839.]
? ——— ——— Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 427.
——— (**Gutt.**) **austriaca**, d'Orb. Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 25, pl. 31. [*Guttulina*, 1846.]
——— **avena**, Terquem. Quatr. Mém. Foram. Lias, 1864, 309, xiii, 45*a*, *b*.
——— **avia**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 307 and 337, I, f. v. [" May be *Bulimina*," P. & J.] [Glauconite.]
——— **biaperta**, Dunikowski. Kosmos [Lemberg], IV, 1879, 129, plate, 23.
——— **bilocularis**, Terquem. Quatr. Mém. Foram. Lias, 1864, 293, xi, 9–32.
——— ——— ——— Terquem, Six. Mém. Foram. Lias, 1866, 523, xxii, 26.
——— ——— ——— Terquem, Quatr. Mém. Foram. Oolithique, 1874, 293, xxx, 7–35; xxxi, 1–18.
——— ——— ——— Terq. et Berth., Mém. Soc. géol. France, [2], X, 1875, 67, v (xv), 18*a*–*q*.
——— ——— ——— Terquem, Bull. Soc. géol. France, [3], IV, 1876, 497, xvii, 13*a*–16.

POLYMORPHINA compressa, d'Orbigny. P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 170, xi, 105. [See *P. tuberosa.*]
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 470, xvii, 32.
——— ——— ——— Schlumberger, F. Jeun. Nat., Jan. 1882, i, 16.
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 620, xxiii, 43.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 182, ii, 21.
——— ——— ——— Brady, Report Challenger, 1884, 565, lxxii, 9–11; fistulose form, lxxiii, 17.
——— ——— ——— Mariani, Boll. Soc. geol. Ital. VII (1889), 288, x, 13.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 113, vi, 10.
——— ——— ——— See *P. lactea* (W. & J.)
——— **compressa**, Philippi. Tertiär. nordwest. Deutsch. 1843, 69, i, 35.
——— **compressiuscula**, Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 647, ii, 82*a*, *b*.
——— **concava**, Williamson. B., P., & J., Trans. Linn. Soc. XXVII, 1870, 236, xl, 22*a*, *b*. [v. *P. lactea.*]
——— **consecta**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 265, No. 10.
——— **contorta**, Stache. Novara-Exped., Geol. Theil I, 1864, 257, xxiv, 4*a*, *b*.
——— **(Glob.) costata**, Egger. Neues Jahrbuch, 1857, 291, xiv, 5 and 6.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 240, xli, 31*a*, *b*.
——— **crassa**, Roemer. Neues Jahrbuch, 1838, 385, iii, 27.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 250, viii, 82.
——— **(Gutt.) crassatina**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 385, iii, 30.
——— **cruciata**, Terquem. Quatr. Mém. Foram. Lias, 1864, 299, xiii, 1–16.
——— ——— ——— Terquem, Six. Mém. Foram. Lias, 1866, 524, xxii, 27*a*, *b*.
——— ——— ——— Terquem, Quatr. Mém. Foram. Oolithique, 1874, 301, xxxii, 12–27.
——— ——— ——— Terq. et Berth., Mém. Soc. géol. France, [2], X, 1875, 69, vi (xvi), 2*a*–*g*.
——— ——— ——— Terquem, Bull. Soc. géol. France, [3], IV, 1876, 498, xvii, 18–22.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 63, vii, 16 and 17.
——— **cylindroides**, Roemer. Neues Jahrbuch, 1838, 385, iii, 26. [v. *Proroporus.*]
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 249, viii, 78.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 221, xxxix, 6*a*, *b*, *c*.
——— **(Gutt.) damæcornis**, Reuss. Verstein. böhm. Kreide, 1845–46, i, 40, xiii, 85.
——— ——— ——— Wright, Rept. Proc. Belfast Nat. F. C., App. III, 1875, 85 [87], iii, 16 and 17.
——— **decora**, Reuss. Bull. Ac. Roy. Belg. [2], XV, 1863, 152, iii, 41.
——— **depauperata**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 89, iii, 9*a*–*c*.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 215, fig.
——— **digitata** d'Orb. Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 9, iii, 3.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 19, vi, 3.
——— **digitalis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 235, xiv, 1–4.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 238, xli, 25*a*, *b*.
? ——— ———? ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 183, i, 13.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 141, xiv (xxii), 29*a*, *b*.

POLYMORPHINA gibba, v. æqualis, d'O. B., P., & J., Trans. Linn. Soc. XXVII, 1870, 216, xxxix, 2*c*, *d*. [*Globulina*, 1846.]
——— ———? ——— K. Miller, Schr. Ver. Gesch. Bodensee, Heft VII, 1877, [77], iv, 19. [Cast or concretion ?].
——— ——— ——— Brady, Report Challenger, 1884, 561, lxxi, 12*a*, *b*; fistulose form, lxxiii, 16.
——— **(Glob.)** ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 209, ix, 10–13.
——— **(Glob.)** ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.
——— ——— ——— Wright, Proc. Belfast Nat. Field Club, 1884–85, App. IX, 1886, 329, xxvi, 11. (Fistulose.)
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 755, xvi, 5.
——— **gibbosa**, Terquem. Mém. Soc. géol. France, [3], IV, 1886, 63, vii, 15.
——— **gigantea**, Stache. Novara-Exped., Geol. Theil I, 1864, 262, xxiv, 9*a*, *b*.
——— **gigas**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 384, xvi*b*, 44.
——— **glabra**, Ehr. Mikrogeologie, 1854, xxix, 30. [= *Virg. squamosa.*]
——— **(Glob.) globosa**, von Muenster. Roemer, Neues Jahrbuch, 1838, 386, iii, 33. [v. *Globulina.*]
——— **(Glob.)** ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 40, xiii, 82.
——— ——— ——— Karrer, Sitz. k. Ak. Wiss. Wien, LII, Abth. 1, 1865 (1866), 497, pl., 12.
? ——— **globulosa**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 373.
——— **globularis**. See *Orth. unilocularis* = *G. globosa.*
——— **glomerata**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 97, xv, 19.
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 40, xii, 32.
——— **gracilis**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, Abth. 1, 1870, 486; von Schlicht, xxxi, 34, 35, "Foram. Septar. Pietzpuhl," 1870, xxxii, 5–8, 27, 28.
——— **(Glob.) granulosa**, Egger. Neues Jahrbuch, 1857, 290, xiv, 1 and 2.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 238, xli, 26*a*, *b*.
——— **gravis**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 181, ii, 12.
——— **(Pyrulina) gutta**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 28, xii, 5 and 6. [v. *Pyrulina.*]
——— ——— ——— D'Orbigny, Modèles, No. 30, 1826.
——— **(Pyrulina)** ——— ——— P., J., & B. [d'O., Modèles, 30], Ann. Mag. Nat. Hist. [3], XVI, 1865, 24, ii, 51.
——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., i, 46 and 47.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 218, xxxix, 3*a*, *b*.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 171, xi, 107.
——— **(Pyrulina)** ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 755, xvi, 6.
——— **(Pyrul.)** ——— ——— = *P. gutta*, d'O. See *Polymorphum.*
——— ——— ——— See *Orth. unilocularis*, etc.
——— **guttata**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, Abth. 1, 1870, 487; von Schlicht, "Foram. Septar. Pietzpuhl," 1870, xxx, 25–32.
——— **guttiformis**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 42, ix (xiv), 24*a*, *b*.
——— **guttula**, Reuss. B., P., & J., Trans. Linn. Soc. XXVII, 1870, 215, cut. [*Globulina*, 1851.]
——— **gyzensis**, Ehrenberg. Mikrogeologie, 1854, xxiii, 26, 27? [Probably Textularian.] [Compare *Grammobotrys* and *Sphæroidina.*]

[* Zittel refers to the Monogr. Polymorph., Trans. Linn. Soc. XXVII, 1869; and, although *P. inflata* is not mentioned therein, *P. lactea* (W. & J.), pl. xxxix, fig. 1, is very close to this form.]

POLYMORPHINA lactea, Walker & Jacob. J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., i, 48.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 213, xxxix, 1*a*–*c*.
——— ——— ——— v. **acuminata**, Will. B., P., & J., Trans. Linn. Soc. XXVII, 1870, 222, xxxix, 6*c*. [v. *supra*.]
——— ——— ——— v. **amygdaloides**, Reuss. B., P., & J., Trans. Linn. Soc. XXVII, 1870, 214, figg. in text, 215. [*Globulina*, 1851.]
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, xl, 12*a*.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 170, xi, 104. [v. *P.* (*Glob.*) *ovata*, d'O.]
——— ——— ——— Dawson, Canad. Nat. VI, 1872, 254, iii, 2.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 37, v, 12 ; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Toula, Mitth. geogr. Ges. Wien, XVIII, 1875, 165, pl., 17.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 79, x, 19 and 20 ; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Nicholson, Manual Palaeont. 1879, i, 114, fig. 18*j*.
——— ——— ——— Brady, Report Challenger, 1884, 559, lxxi, 11 ; 14 var. and fistulose form, lxxiii, 14.
——— ——— ——— Gümbel, Geol. Bayern, Th. I, Lief. 2, 1885, fig. 266, 15.
——— ——— ——— Dawson, Handbook Zoology, ed. 3, 1886, 44, fig. 34.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 224, xliv, 11.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei [4], VI, 1889, 113, vi, 8, 9.
——— ——— ——— See *Misilus* ; *Cantharus* ; and *Arethusa*.
——— **lagenalis**, Terquem. Quatr. Mém. Foram. Lias, 1864, 301, xiii, 39*a*, *b*.
——— **lanceolata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 83, vi, 50.
——— (**Gutt.**) ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 58 and 67, vii, 75*a*–*c*, 76, 77*a*, *b*, 78*a*, *b*, 79–84.
——— ——— ——— Brady, Report Challenger, 1884, 564, lxxii, 5 and 6.
——— (**Gutt.**) ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 210, ix, 18–20.
——— (**Gutt.**) **lata**, Egger. Neues Jahrbuch, 1857, 288, xiii, 22–24.
——— **leopolitana**, Reuss. Haidinger's Naturw., Abh. IV, (1), 1851, 44, iv, 11.
——— **leprosa**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, (1), 1867, 89, iv, 3*a*–*c*.
——— **liassica**, Strickland. Quart. Journ. Geol. Soc. II, 1846, 30, fig. *b*.
——— ——— ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 220, fig.
——— **ligua**, Roemer. Neues Jahrbuch, 1838, 385, iii, 25. [Name corrected to *lingua*.]
——— [**lingua**] ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 248, vii, 77.
——— [———] ——— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 230, fig.
——— **lingulata**, Stache. Novara-Exped., Geol. Theil I, 1864, 255, xxiv, 1*a*, *b*.
——— **longicollis**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 181, ii, 11.
——— **longicollis**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 64.
——— ——— ——— Brady, Report Challenger, 1884, 572, lxxiii, 18 and 19.
? ——— **longirostrata**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 178, v, 14 and 15. [*P. longirostris* in explanation to plate.]
——— **longirostris**, Gümbel. See *P. longirostrata*.
——— **longissima**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, n. d. xiii, 22 and 23.
——— **marsupium**, Stache. Novara-Exped., Geol. Theil I, 1864, 258, xxiv, 5*a*, *b*.
——— **media**, Egger. Neues Jahrbuch, 1857, 287, xiii, 28 and 29.
——— **metensis**, Terquem. Quatr. Mém. Foram. Lias, 1864, 301, xiii, 38*a*, *b*.
——— ——— ——— Terq. et Berth., Mém. Soc. géol. France, [2], x, 1875, 68, vi (xvi), 1*a*–*j*.

POLYMORPHINA orbignii (Zborzewski). Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 200, vii, 37.
—— —— —— Jones, in Microgr. Dict. ed. 4, 1883, 620, xxiii, 41.
—— **ornata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, (1), 1868, 175, iv, 10.
—— —— —— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 242, xli, 34*a*, *b*.
—— **ovata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 233, xiii, 1–3.
—— —— —— Brady, Report Challenger, 1884, 564, lxxii, 7 and 8.
—— —— —— Agassiz, Three Cruises "Blake," II, 1888, 166, fig. 509.
—— **(Glob.)** —— —— = *P. lactea* (W. & J.). See *Polymorpha subcordiformia*, etc. [*Globulina*, 1826.]
—— **oviformis**, Terquem. Cinq. Mém. Foram. Lias, 1866, 449, xviii, 12*a*, *b*.
—— —— —— Terquem, Mém. Soc. géol. France, [3], I, 1878, 40, iii (viii), 34*a*, *b*.
—— **ovigera**, Terquem. Quatr. Mém. Foram. Lias, 1864, 304, xiv, 1–15.
—— **ovula**, Terquem. Quatr. Mém. Foram. Lias, 1864, 294, xi, 33–44.
—— **ovulata**, Dunikowski. Kosmos [Lemberg], IV, 1879, 128, plate, 22.
—— **ovulum**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 250, viii, 83.
—— **pauperata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 38, iii (viii), 11*a*–19.
—— **pernæformis**, Stache. Novara-Exped., Geol. Theil I, 1864, 256, xxiv, 2*a*, *b*.
—— **philippii**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 248, vii, 76.
—— **pigmæa**, Schwager. Jahresb. Ver. vat. Nat. Württ. XXI, 1865, 138, vii, 8. [*Polimorphina* on p. 138, and *pygmæa* in descript. of plates.]
—— **piriformis**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 302, xxxiii, 2.
—— **polita**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 139, xiv (xxii), 23–25.
—— **polygona**, Terquem. Quatr. Mém. Foram. Lias, 1864, 305, xiv, 16–41.
—— —— —— Terquem, Quatr. Mém. Foram. Oolithique, 1874, 304, xxxiii, 7–14.
—— —— —— Terq. et Berth., Mém. Soc. géol. France, [2], X, 1875, 70, vi (xvi), 3.
—— —— —— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 63, vii, 18*a*, *b*.
—— **prælonga**, Egger. Neues Jahrbuch, 1857, 287, xiii, 25–27.
—— **prælonga**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 39, iii (viii), 20–21*b*.
—— —— —— Terquem, Mém. Soc. géol. France, [3], II, 1882, 142, xiv (xxii), 34–45 ; and xv (xxiii), 1–8.
—— **prisca**, Ehr. Mikrogeologie, 1854, xxiv, 34. [= *P. compressa*, d'O.]
—— **prisca**, Reuss. Berthelin, Mém. Soc. géol. France, [3], I, 1880, 57, iv (xxvii), 20*a*–21. [*Globulina*, 1862.]
—— **problema**, d'Orbigny. Modèles, No. 61, 1826. [v. *Guttulina*.]
—— **(Gutt.)** —— —— Egger, Neues Jahrbuch, 1857, 287, x, 23–25.
—— —— —— v. **deltoidea**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 154, iv, 8.
—— **(Gutt.)** —— —— P., J., & B. [d'O., Modèles, 61], Ann. Mag. Nat. Hist. [3], XVI, 1865, 28, ii, 50.
—— —— —— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., i, 64.
—— —— —— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 225, xxxix, 11*a*, *b*.
—— —— —— v. **deltoidea**, Reuss. Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 50, viii, 3 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 59, same pl. and fig. [*P. gibba*, d'O., var. *deltoidea*, Rss., in descr. of plate.]
—— —— —— Tate & Blake, Yorkshire Lias, 1876, 470, xvii, 33.
—— **(Gutt.)** —— —— v. **deltoidea**, Reuss. Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 210, ix, 21.

POLYMORPHINA septata, Terquem. Quatr. Mém. Foram. Lias, 1864, 301, xiii, 40.

—— **silicea**, Schultze. Organismus Polythal. 1854, 61, vi, 10 and 11. [= *Verneuil. polystropha.*]

—— **similis**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 249, vii, 79.

—— **simplex**, Terquem. Quatr. Mém. Foram. Lias, 1864, 293, xi, 1–4. [= *Lituolæ.*]

—— —— —— Terq., Quatr. Mém. Foram. Oolithique, 1874, 292, xxx, 3–6.

—— —— —— Terq. et Berth., Mém. Soc. géol. France, [2], x, 1875, 66, v (xv), 17*a–d*.

—— —— —— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 61, vii, 8.

—— **simplex**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 119, i, 12.

—— **sinuata**, Terquem. Quatr. Mém. Foram. Lias, 1864, 298, xii, 48.

—— **soldanii**, d'Orb. Ann. Sci. Nat. VII, 1826, 265, No. 12.

—— —— —— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 235, xl, 20.

—— —— —— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 170, xi, 106.

—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 183, ii, 22.

—— —— —— See *Orthoceratia tuberosa.*

—— **solidula**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 40, iii (viii), 31*a*–33.

—— **(Gutt.) sororia**, Reuss. Bull. Ac. Roy. Belg. [2], XV, 1863, 151, ii, 25–29.

—— **(Gutt.)** —— —— Reuss, Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 57 and 67, vii, 72*a–c*, 73 and 74.

—— —— —— Brady, Report Challenger, 1884, 562, lxxi, 15 and 16; fistulose form, lxxiii, 15.

—— —— —— v. **cuspidata.** Brady, Report Challenger, 1884, 563, lxxi, 17, 19; lxxii, 4.

—— —— —— Walther, Mitth. Zool. Stat. Neapel, VIII, 1888, 382, xx, 4.

—— **spatulata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 142, xiv (xxii), 32*a*, *b*.

—— **(Gutt.) spicæformis**, Roemer. Neues Jahrbuch, 1838, 386, iii, 31.

—— **(Glob.) spinosa**, d'Orb. Egger, Neues Jahrbuch, 1857, 292, xiv, 9 and 10. [*Globulina*, 1846.]

—— —— —— B., P., & J., Trans. Linn. Soc. XXVII, 1870, 243, xlii, 36*a*, *b*.

—— —— —— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 347, xii, 27.

—— **squammata**, Terquem. Quatr. Mém. Foram. Lias, 1864, 297, xii, 37–40.

—— **(Glob.) striata**, Egger. Neues Jahrbuch, 1857, 291, xiv, 3 and 4.

—— **subacuta**, d'Orb., 1847. Prodrome de Paléont. III, 1852, 159, No. 2978. [*P. acuta*, d'O., 1846.]

—— **subcompressa**, d'Orb., 1847. Prodrome de Paléont. III, 1852, 159, No. 2976. [*P. compressa*, d'O., 1846.]

—— —— —— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 233, xxxv², 29*a*, *b*, *c*.

—— **subcruciata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 140, xiv (xxii), 26 and 27.

—— **subcylindrica**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 51, xiv, 14; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 60, same pl. and fig. [Misprinted *subcyindrica* in descr. of plate.]

—— **subdepressa**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 385, iii, 28. [See *Proroporus.*]

POLYMORPHINA ventricosa, Terquem. Quatr. Mém. Foram. Lias, 1864, 302, xiii, 42*a*, *b*.
——— **viciensis**, Terquem. Quatr. Mém. Foram. Lias, 1864, 302, xiii, 41.
——— **zeuschneri**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 90, iv, 1*a*–*c*.
——— Ansted, Geology, 1844, ii, 63, fig. *g*.
——— Pictet, Traité de Paléont. IV, 1846, 239, xii, 26.
——— Pictet, Traité de Paléont. 2 ed. IV, 1857, 519, cix, 39.
——— Dawson, Canad. Nat. II, 1857, 422, vii, 19 and 20.
——— J. G. Wood, Common Objects Micro. 1867, 121, xii, 15.
——— See Brady, Parker, & Jones, Trans. Linn. Soc. XXVII, 1870, 206, etc.
——— v. Schlicht, Foram. Septar. Pietzpuhl, 1870, plate xxxii.
——— Chimmo, Bed of Atlantic, 1870, 27, x, 2.
[**Polymorphinæ**?] Terquem, Mém. Soc. géol. France, [3] I, 1878, 48, iv (ix), 40, 41.
——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 374, i, 13.
——— Green, Amer. Journ. Micros. VI, 1881, 46, pl., 7.
——— De Folin, Le Naturaliste, Ann. 9, 1887, 140, fig. 19.
———? see *Canopus*.
——— see *Guttulina*.
——— see *Globulina*.
——— see *Pyrulina*.
POLYPHRAGMA, Reuss, 1871. Sitz. k. Ak. Wiss. Wien, LXIV, Abth. 1, 1871, 277. [*Lichenopora*, 1846.]
——— **cribrosum**, Rss. Ibid.; and Reuss, in Geinitz, Palaeontographica, XX, Th. 1, 1872, 139, xxxiii, 8 and 9.
——— **sp.**, Schwager. Boll. R. Com. geol. Ital. 1877, viii, 26, pl., 88.
POLYSPHÆRINA, Deshayes, 1830. See *Globulina*, Deshayes.
POLYSTOMATIUM, Ehr., 1855. Abh. k. pr. Ak. Wiss. Berlin, 1855, 172, v, xii. [= *Polystomella*.] [Glauc.]
——— **leptactis**, Ehr. Abh. k. pr. Ak. Wiss. Berlin, 1855, 171, v, xiii–xv. [= *Polystomella craticulata*; see Carpenter, "Introd.," xvi, 9.] [Glauc.]
POLYSTOMELLA, Lamarck, 1822. Hist. Anim. s. Vert. VII, 1822, 625; Brady, Report Challenger, 1884, 731.
——— **aculeata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 131, vi, 27 and 28.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 303, xv, 3 and 4.
——— ——— ——— Reuss' Models, No. 77, 1865 (Catal., No. 93, 1861).
——— **æquivoca**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 221, xix, 11, *A*, *B*.
——— **alvareziana**, d'Orbigny. Voyage Amér. Mérid. v, pt. 5, 1339, "Foraminifères," 31, iii, 11 and 12.
——— **ambigua** (F. & M.). D'Orbigny, Ann. Sci. Nat. VII, 1826, 285, No. 10. [*Nautilus*, 1798.]
——— ——— See *Pelorus*.
——— **angularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 284, No. 2.
——— **angulata**, Egger. Neues Jahrbuch, 1857, 302, xv, 5 and 6.
——— **antonina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 128, vi, 17 and 18.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 47, ii (x), 25*a*, *b*.
——— **arctica**, Parker & Jones, MS. Brady, Trans. Linnean Soc. XXIV, 1864, 471, xlviii, 18. [See also *Nonion. boueana*, d'O., Balkwill & Wright.]
——— ——— ——— See *P. crispa*. Phil. Trans. 1865, 401, xiv, 25–30.
——— ——— ——— Dawson, Canad. Nat. [n. s.] v, 1870, 177, fig. 8.
——— ——— ——— Dawson, Amer. Journ. Sci. [3], I, 1871, 206, fig. 8; and Ann. Mag. Nat. Hist. [4], VII, 1871, 86, fig. 8.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 24, ii, 1*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Brady, Ann. Mag. Nat. Hist. [5], I, 1876, 437, xxi, 13*a*–*d*.

POLYSTOMELLA crispa [Linn.]. Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 212, xi, 10*a*, *A*, *B*, *C* [error for xiv, 11]; xix, 17; xx, 3.
—— —— [Lam.]. Egger, Neues Jahrbuch, 1857, 303, xv, 1, 2.
—— —— —— Parker & Jones, Ann. Mag. Nat. Hist. [2], XIX, 1857, 288, xi, 19.
—— —— —— Williamson, Recent British Foram. 1858, 39, iii, 78–80.
—— —— —— Carpenter, Phil. Trans. 1860, 535 to 548, xvii, 9 and 10.
—— —— —— Carpenter, Parker, & Jones, Introd. Foram. 1862, 278, iv, 28; xvi, 5 and 6. [Structural.]
—— —— —— P., J., & B. [d'O., Modèles, 45], Ann. Mag. Nat. Hist. [3], XVI, 1865, 26, iii, 96.
—— —— —— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 239, xii, 155. [See *P. strigillata* (F. & M.).]
—— —— —— Parker & Jones, Phil. Trans. 1865, 399, xiv, 24; xvii, 61*a*, *b*.
—— —— —— v. **arctica**, Parker & Jones. Phil. Trans. 1865, 401, xiv, 25–30. [See *P. arctica.*]
—— —— —— v. (**Nonion.**) **asterizans** (F. & M.). Parker & Jones, Phil. Trans. 1865, 403, xiv, 35; xvii, 54*a*, *b*.
—— —— —— v. (**Nonion.**) **depressula** (W. & J.). Parker & Jones, Phil. Trans. 1865, 403, xiv, 39*a*, *b*.
—— —— —— v. (**Nonion.**) **faba** (F. & M.). Parker & Jones, Phil. Trans. 1865, 402, xiv, 36.
—— —— —— v. (**Nonion.**) **scapha** (F. & M.). Parker & Jones, Phil. Trans. 1865, 404, xiv, 37 and 38; xvii, 55 and 56.
—— —— —— v. (**Nonion.**) **stelligera** (d'O.). Parker & Jones, Phil. Trans. 1865, 404, xiv, 40 and 41.
—— —— —— v. **striatopunctata** (F. & M.). Parker & Jones, Phil. Trans. 1865, 402, xiv, 31–34; xvii, 60*a*, *b*. [See *P. striatopunctata.*]
—— —— —— v. (**Nonion.**) **turgida** (Will.). Parker & Jones, Phil. Trans. 1865, 405, xvii, 57*a*, *b*, *c*.
—— —— —— v. (**Nonion.**) **umbilicatula** (Mont.). Parker & Jones, Phil. Trans. 1865, 405, xiv, 42*a*, *b*; xvii, 58 and 59.
—— —— —— Hartwig, The Sea, ed. 3, 1866, 381, fig. *c*.
—— —— —— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., ii, 40–43.
—— —— —— Greene, Man. Protozoa, 1871, 15, fig. 3*c*.
—— —— —— Dawson, Canad. Nat. VI, 1872, 255, iii, 2. [= *P. arctica.*]
—— —— —— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 24, i, 19*a*, *b*; (and Mém. Soc. Dunkerquoise).
—— —— [Lam.]. Toula, Mitth. geogr. Ges. Wien, XVIII, 1875, 165, pl., 20.
—— —— [Lam.]. Zittel, Handbuch Palaeont., Abth. 1, 1876, 101, fig. 41.
—— —— [Lam.]. Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 16.
—— —— —— Nicholson, Manual Palaeont. 1879, i, 118, fig. 18*s*.
—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 214, iv, 71 and 72.
—— —— v. **crassa**, Möbius. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 101, xi, 4–7; xii. [Structural.]
—— —— v. (**Nonion.**) **umbilicatula**, Mont. Hamilton, Trans. N. Zealand Inst. XIII, 1881, 395, xvi, 14.
—— —— —— v. **poeyana**, d'Orb. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 116, viii, 301 and 302. [See *P. poeyana.*]
—— —— —— Jones, in Micrógr. Dict. ed. 4, 1883, 623, xxiii, 55; xxiv, 20*a*, *b*.
—— —— —— West, Journ. Postal Micros. Soc. II, pt. 5, 1883, 41, xxi, 1–3.
—— —— —— Brady, Report Challenger, 1884, 736, cx, 6 and 7.

POLYSTOMELLA imperatrix, Brady. Report Challenger, 1884, 738, cx, 13–15.
——— **indigena**, Eichwald. Lethaea Rossica, III, 1853, 4, i, 2*a*, *b*, *c*. [*Lenticulina*, 1830.]
——— **inflata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 358, i, 10*a*, *b*.
——— **josephina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 130, vi, 25 and 26.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 303, xv, 10 and 11.
——— ——— ——— Hoernes, Elem. Palaeont. 1884, 25, fig. 11; French ed. 1886, same fig.
——— **karreri**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 128, ii, 4.
——— **lævigata**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 288, ii, 7.
——— ——— ——— Michelotti, Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, II verzam. 3 dl. 2 stk. 1847, 18, not fig'd.
——— **laminata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 16, i (vi), 8*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 47, ii (x), 24*a*, *b*.
——— **lanieri**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 54, vii, 12 and 13; also in Spanish, 1840, 74, same pl. and fig.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5, (1885) 1056, lxxxvi, 42.
——— **latidorsata**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 10, i, 16.
——— **lessonii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 284, No. 6.
——— ——— ——— D'Orbigny, Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 29, iii, 1 and 2.
——— **listeri**, d'Orbigny. Foram. Fossiles Vienne, 1846, 128, vi, 19–22.
——— **macella** (F. & M.). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 239, xii, 154. [See *Nautilus*, 1798.]
——— ——— ——— Brady, Report Challenger, 1884, 737, cx, 8, 9, 11, and 10?
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 120, x, 3.
——— ——— ——— See *Ammoniæ*.
——— ——— ——— See *Elphidium* and *Geophonus*.
——— **metensis**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 628, iv, 7*a*, *b*.
——— **minima**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 333, xvii, 38, 38*a*.
——— **minuta**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 478, iv, 6*a*, *b*.
——— **nobilis**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 710, ii, 15.
? ——— **obscura**, Schwager. Palaeontographica, XXX, Pal. Theil, 1883, 138, xxvii (4), 2*a–c*.
——— **obtusa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 124, vi, 5 and 6.
——— **oceanensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 285, No. 8.
——— **ornata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 215, x, 8; xix, 16*A*, *B*, *C*.
——— **ortenburgensis**, Egger. Neues Jahrbuch, 1857, 302, xv, 7–9.
——— **oweniana**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 30, iii, 3 and 4.
——— **planulata**, Lamarck. Hist. Anim. s. Vert. VII, 1822, 625.
——— ——— ——— Defrance, Dict. Sci. Nat. XXXII, 1824, 183; Atlas, Conch. xv, 8. [= *P. macella* (F. & M.).]
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 388, viii [error for vii], 8.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, iv *bis*, 8.

POLYSTOMELLA subumbilicata, Czjzek. Haidinger's Nat. Abh. II, 1848, 143, xii, 32 and 33.
——— **tenuissima**, Karrer. Novara-Exped., Geol. Theil I, 1864, 83, xvi, 17 [error for 16].
——— **teretiuscula**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 16, i (vi), 9*a*–10*b*.
——— **umbilicata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 285, No. 9.
——— **umbilicatula**, Walker & Boys. See *Nautilus*.
——— ——— ——— Williamson, Recent British Foram. 1858, 42, iii, 81, 82, 82*a* (v. *incerta*). [= *P. striatopunctata*.]
——— ——— ——— v. **incerta**, Williamson. Recent British Foram. 1858, 44, iii, 82*a*. [= *P. arctica*, P. & J.]
——— ——— ——— Dawson, Canad. Nat. IV, 1859, 27, fig. 1.
——— ——— ——— Cooke, Thousand Objects Microsc. 1869, 92, ix, 17.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 25, ii, 3*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— West, Journ. Postal Micros. Soc. II, pt. 5, 1883, 42, xxi, 4 and 5.
——— **ungeri**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 369, xlviii, 2.
——— **venusta**, Schultze. Organismus Polythal. 1854, 67, vi, 7–9.
——— ——— ——— Haeckel, Das Protistenreich, 1878, 36, fig. 20.
——— **verriculata**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 66.
——— ——— ——— Brady, Report Challenger, 1884, 738, cx, 12*a*, *b*.
——— **vortex**, Blainville. Man. Malacol. 1825, 389. [= *Cristellaria*, q. v.]
——— **vulgaris**, Reeve. Conch. system. II, 1842, 291, ccxcvii, 8. [*Planorbulina*, d'O. = *Planorb.*]
[———?] Ledermüller, Mikr. Gemüths, 1763, 16, viii, *b*.
——— Pictet, Traité de Paléont. IV, 1846, 229, xii, 11.
——— Rütimeyer, Nouv. Mém. Soc. Helvet. Sci. Nat. XI, 1850, Mém. 2, iv, 57.
——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 276, xvi. [Structural.]
——— J. G. Wood, Common Objects Micro. 1867, 121, xii, 13.
——— Carpenter, Ency. Brit. 9th ed. IX, 1879, Foraminifera, 374, i, 16.
——— ind. Abich, Geol. Forsch. Kaukas. Ländern, 1882, 239, x, 6.
——— sp. Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 230, xliii, 18.
——— Neumayr, Stämme d. Thierreiches, I, 1889 (8), 185, fig. 27*b*.
——— see *Nautile*.
——— see *Nautilus*.
"**Polythalamia**" (cretaceous), Hitchcock, Elem. Geology, 1860, 30th ed. 382, 383, figures. [*Textularia*, *Globig.*, *Planorb.*]
POLYTREMA, Risso, 1826. Hist. Nat. Europe Mérid. v, 1826, 340; Brady, Report Challenger, 1884, 719.
——— **balaniforme**, Carter, 1876. Carter, Ann. Mag. Nat. Hist. [4], XVII, 1876, 198, xiii, 7–10. [*Carpenteria*, Gray, 1858.]
——— **corallina**, Risso. Hist. Nat. Europe Mérid. v, 1826, 340, n. fig.
——— **cylindricum**, Carter. Ann. Mag. Nat. Hist. [5], v, 1880, 441, xviii, 1*a*–*g*.
——— **marticensis**, Sassan d'Allard. Bull. Soc. géol. France, [3], XII, 1884, 565.
——— **mesentericum**, Carter. Ann. Mag. Nat. Hist. [5], v, 1880, 444, xviii, 3*a*–*h*.
——— **miniacea** (Pallas). See *Millepora*, 1766.
——— ——— [Esper]. Defrance, Dict. Sci. Nat. Atlas, Zooph. 1816–30, xliv, 4, 4*a*.
——— ——— ——— Blainville, Actinologie, 1834, 410, lxix, 4, 4*a*.
——— **[miniaceum]** ——— Schultze, Arch. für Naturgesch. (Wiegmann's), 1863 (29th Jahrg.), i, 81–102, pl. viii; and Ann. Mag. Nat. Hist. [3], XII, 1863, 408, vii.
——— **[miniaceum]**, [Blainv. (1834)]. Carter, Ann. Mag. Nat. Hist. [4], XVII, 1876, 185, xiii, 1–6.

Porpitæ soluti, rotundi, numismatis, figura, Soldani. Sagg. Oritt. 1780, 106, iv, 34*G, H.* [= *Assilina.*]
Porpite, Guettard, Mém. diff. parties Science, etc. III, 1770, 431, xii, 15 and 17. [= ? *Alveolina.*]
Porpiten, Fortis, Beschreib. Thales Ronca, 1779, 14, i, 1. [Also called "pietra da soldo."] [= *Nummulites.*]
Porpites, Deluc, Journ. Physique, LVI, 1802, 325, etc. plate, fig. 7–12. [*Orbitolites.*]
PREMNAMMINA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 136, n. d. (2 species proposed under generic name of *Psammechinus*); and Congrès Scient. Dax, 1882 (1883), 327.
PROBLEMATINA, Bornemann, 1874. Zeitschr. deutsch. geol. Ges. XXVI, 1874, 733.
——— **deslongchampsi** (Terq.). Idem, 733. [*Involutina*, 1863.]
——— **nodosa** (Terq.). Idem, 735. [*Involutina*, 1866.]
——— **petræa** (Terq.). Idem, 734. [*Involutina*, 1866.]
PROROPORUS, Ehrenberg, 1844. Ber. k. pr. Ak. Wiss. Berlin, 1844, 75.
——— **argus**, Ehr. Mikrogeologie, 1854, xx, ii, 8. [= *Boliv. punctata.*]
? ——— **clavulina**, Ehr. Mikrogeologie, 1854, xxx, 15. [= *Boliv. dilatata* = *B. incrassata*, Reuss.]
——— **complanatus**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 231, xii, 5*a, b.*
——— ——— ——— Reuss' Models, No. 41, 1865 (Catal., No. 76, 1861). [= 1st stage of a *Bigenerina.*]
——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 33.
——— **cretæ**, Ehr. Mikrogeologie, 1854, xxvii, 29, and xxviii, 20. [= *Polym. thouini.*]
——— ———? Ehr. Mikrogeologie, 1854, xxxvii, vi, 2. [= ? *Polymorphina.*]
——— **cylindroides**, Roemer. Reuss, in Geinitz, Grundr. Verstein, 1845–46, 678, xxiv, 80. [*Polymorphina*, 1838.]
——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 234, xxxv^2, 31*a, b.*
? ——— **denticulatus**, Ehr. Ber. k. pr. Ak. Wiss. Berlin, 1845, 374.
——— **lingua**, Ehr. Ber. k. pr. Ak. Wiss. Berlin, 1844, 67 and 95; and Mikrogeologie, 1854, xxi, 83. [= *Boliv. punctata*, ribbed v.]
——— **obtusus**, Ehr. Mikrogeologie, 1854, xxxii, ii, 23. [= *Polym. compressa.*]
——— ———? ——— Ehr., Mikrogeologie, 1854, xxxii, II, 24. [= *Bigen. digitata*, d'O.]
——— **ombonii**, Hantken. Ertek. Termesz. köreböl, XIII, No. 1, 1883, 10, i, 3; and Math. Nat. Ber. Ungarn, II, 1884, 131.
? ——— **(Gramm.?) pachyderma**, Ehr. Mikrogeologie, 1854, xxiii, 25. [= *Text. agglutinans.*]
——— **schultzei**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 80, ix, 10*a, b.*
——— **siculus**, Ehr. Mikrogeologie, 1854, xxvi, 18. [= probably *Polym. thouini.*]
——— **subdepressus**, Münster. Reuss, in Geinitz, Grundr. Verstein. 1845–46, 679, xxiv, 81. [*Polymorphina*, 1838.]
——— **verrucosus**, Ehr. Mikrogeologie, 1854, xxix, 29. [= *Polym. tuberculata*, (d'O.).]
——— Schwager, Jahresh. Ver. vat. Nat. Württ. XXI, 1865, vii, 19.
PROTEONINA, Williamson, 1858. Recent British Foram. 1858, 1.
——— **fusiformis**, Williamson. Recent British Foram. 1858, 1, i, 1. [v. also *Reophax.*]
——— **lævigata**, Terquem. Ess. Anim. Plage Dunkerque, pt. I, 1875, 20, i, 2*a, b*; (and Mém. Soc. Dunkerquoise). [= ?.]
——— **pseudospirale**, Williamson. Recent British Foram. 1858, 2, i, 2 and 3. [v. also *Haplophragmium.*]

PTYGOSTOMUM orphei, Ehr. Ber. k. pr. Ak. Wiss. Berlin, 1854, 248.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxv, *B*, iv, 1 and 2. [= *Globig. bulloides.*]
——— **quinarium**, Ehr. Mikrogeologie, 1854, xxxii, i, 28. [= *Globig. hirsuta*, d'O.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 43. [= *Planorb. vulgaris.*]
——— **senarium**, Ehr. Mikrogeologie, 1854, xxxii, i, 27. [= *Globig. hirsuta*, d'O.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 42. [= *Planorb. vulgaris.*]
——— sp., Harting, Verh. Kon. Ak. Wetensch. x, 1864, 9, i, 6 and 7.
PTYKA, de Folin, 1881. Bull. Soc. N. H. Toulouse, xv, 139, n. d.; 1 sp. proposed.
PULLENIA, Parker & Jones, 1862. C., P., & J., Introd. Foram. 1862, 184; Brady, Report Challenger, 1884, 614.
——— **bulloides** (d'Orbigny). C., P., & J., Introd. Foram. 1862, 184, xii, 12. [*Nonionina*, 1826.]
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 50, x, 9; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 59, same pl. and fig.
——— ——— ——— Zittel, Handbuch Palaeont., Abth. I, 1876, 88, fig. 25[2].
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 25, pl., 14.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 211, ix, 14.
——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 206, ix, 23.
——— ——— ——— Steinmann, Elem. Paléont. I, 1888, 32, fig. 16.
——— **communis** (d'Orb.). Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 50, x, 10; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 59, same pl. and fig. [*P. elongata*, Hantk., on plate.] [See *Nonionina.*]
——— **compressa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 221, xvii, 14, 14*a*.
——— **compressiuscula**, Reuss. Denkschr. k. Ak. Wiss. Wien, xxv, 1866, 150.
——— ——— ——— v. **quadriloba**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 87, iii, 8*a*, *b*.
——— ——— ——— v. **quinqueloba**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 87.
——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 206, ix, 22.
——— **elongata**, Hantken. See *P. communis*, d'Orb.; = *Nonionina.*
——— **falx** (Czjzek). Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 190, i, 22. [*Nonionina*, 1843.]
——— **obliquiloculata**, Parker & Jones. Phil. Trans. 1865, 368, xix, 4*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 618, lxxxiv, 16–20.
——— **quinqueloba**, Reuss. Brady, Report Challenger, 1884, 617, lxxxiv, 14 and 15. [*Nonionina*, 1851.]
——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 348, xii, 29*a*, 29*b*.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 226, xliii, 22 and 23.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 487, xi, 29.
——— **sphæroides**, d'Orbigny. Parker & Jones, Phil. Trans. 1865, 368, xiv, 43*a*, *b*; xvii, 53. [*Nonionina*, 1826.]
——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., ii, 31 and 32.

PULVINULINA canariensis (d'Orb.). Brady, Report Challenger, 1884, 692, ciii, 8–10.
——— ——— ——— Hogg, Microscope, 1886, xviii, iii, 84.
——— ——— ——— See *P. repanda* (F. & M.).
——— **candidula**, Schwager. Palaeontographica, xxx, 1883, Pal. Theil, 133, xxviii (5), 10*a–d*.
——— **caracolla** (Roemer). See *Gyroidina*.
——— ——— ——— Soldani, Testac. I, 1, 1789, 56, pl. 38*G* = var. of this form.
——— **communis** (d'Orbigny). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 173, xii, 145. [*Rotalia*, 1826.]
——— **concentrica**, Parker & Jones, MS. Brady, Trans. Linnean Soc. XXIV, 1864, 470, xlviii, 14.
——— ——— ——— Brady, Report Challenger, 1884, 686, cv, 1*a*, *b*, *c*.
——— ——— ——— Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 190, iii, 3 and 4.
——— ——— ——— Soldani, Testac. I, 1, 1789, 56, pl. 37*B* = this form.
——— **contraria**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, 1870, 490, No. 3; v. Schlicht, Foram. Pietzpuhl, 1870, xxii, 10–13.
——— **cordieriana** (d'Orb.). Jones, Cat. Foss. Foram. Brit. Mus. 1882, 88. [*Rotalina*, 1840.]
——— **cordiformis** (Costa). Reuss, Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 103, v, 3*a*, *b*. [*Valvulina*, 1856.]
——— **crassa** (d'Orbigny). S. R. J. Owen, Journ. Linn. Soc. (Zool.) IX, 1867, 148, v, 18 and 19. [*Rotalina*, 1840.]
——— ——— ——— Brady, Report Challenger, 1884, 694, ciii, 11 and 12.
——— **deludens**, Schwager. Palaeontographica, xxx, 1883, Pal. Theil, 135, no figure.
——— **dispansa**, Brady. Report Challenger, 1884, 687, cxv, 3*a*, *b*.
——— **elegans** (d'Orbigny). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 174, xii, 142. [*Rotalia*, 1826.]
——— ——— ——— Tate & Blake, Yorkshire Lias, 1876, 472, xvii, 38, 38*a*.
——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 111, viii, 283–285.
——— ——— ——— v. **trochus**, Roemer. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 112, viii, 286–288. [*Rotalia*, 1838.]
——— ——— ——— v. **tenella**, Jones. Quart. Journ. Geol. Soc. XL, 1884, 771, xxxiv, 17*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 699, cv, 4, 5, and 6.
——— ——— [Brady]. Walther, Mitth. Zool. Stat. Neapel, VIII, 1888, 382, xx, 6.
——— ——— ——— B., P., & J., Trans. Zool. Soc. XII, pt. 7, 1888, 228, xlvi, 2.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. 1889, 487, xi, 30–32.
——— ——— ——— See *P. repanda* (F. & M.).
——— **erinacea**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 187, v, 6.
——— **exigua**, Brady. Report Challenger, 1884, 696, ciii, 13 and 14.
——— **eximia**, Rzehak. Ann. k. k. Nat. Hofmuseums, III, Heft 3, 1888, 263, xi, 7*a*, *b*, *c*.
——— **favus**, Brady. Geol. Mag. [2], IV, 1877, 535 [not figured].
——— ——— ——— Brady, Report Challenger, 1884, 701, civ, 12–16.
——— **formosa**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 464, iii, 1*a–c*.
——— **haidingeri** (d'Orb.). Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 67, xv, 10; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 77, same pl. and fig. [*Rotalina*, 1846.]
——— **hauerii** (d'Orbigny). Brady, Report Challenger, 1884, 690, cvi, 6 and 7. [*Rotalina*, 1846.]
——— **karsteni** (Reuss). Brady, Trans. Linnean Soc. XXIV, 1864, 470, xlviii, 15. [See *Rotalia*, 1855.]

PULVINULINA nonioninoides, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 256, xi, 2.

——— **normanni**, Karrer. In v. Drasche, Frag. Geol. Luzon, 1878, 97, v, 24; and Bol. Com. Map. Geol. Españ. VII, 1880, 280, *F*, 10.

——— **oblonga** (Will.). Brady, Report Challenger, 1884, 688, cvi, 4*a*, *b*, *c*. [*Rotalina*, 1858.]

——— ——— ——— v. **scabra**, Brady. Report Challenger, 1884, 689, cvi, 8*a*, *b*, *c*.

——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 229, xlvi, 5.

——— **partschiana** (d'Orbigny). See *Rotalina*, 1846.

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, LXII, 1870, 36; v. Schlicht, Foram. Septar. Pietzpuhl, 1870, xx, 23–25, 29–31.

——— [**partschi**] ——— Zittel, Handb. Pal., Abth. I, 1876, 94, fig. 32[1].

——— [**partschi**] ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 42.

——— ——— ——— Brady, Report Challenger, 1884, 699, cv, 3*a*, *b*, *c*; and 700, cut 21.

——— **patagonica** (d'O.). Brady, Report Challenger, 1884, 693, ciii, 7*a*, *b*, *c*. [*Rotalina*, 1839.]

——— **pauperata**, Parker & Jones. Phil. Trans. 1865, 395, xvi, 50, 51*a*, 51*b*. [See *P. repanda* (F. & M.).]

——— ——— ——— Brady, Report Challenger, 1884, 696, civ, 3–11.

——— **perlata**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 216, viii, 12.

——— **petrolei**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 217, viii, 15.

——— **procera**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 66.

——— ——— ——— Brady, Report Challenger, 1884, 698, cv, 7*a*, *b*, *c*.

——— **prominens**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 463, iii, 2*a*–*c*.

——— **punctulata** (d'Orb.). Brady, Report Challenger, 1884, 685, civ, 17*a*, *b*, *c*. [*Rotalia*, 1826.]

——— ——— ——— varr. Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 758, xvi, 22*a*–*c*, 23*a*–*c*.

——— ——— ——— See *P. repanda* (F. & M.).

——— **pulchella** (d'Orbigny). J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., ii, 25–27. [*Rotalia*, 1826.]

——— ——— ——— Soldani, Testac. I, 1, 1789, 56, pl. 35*R* = this form.

——— ——— ——— See *Cidarollus*.

——— **pygmea**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 67, x, 8; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 78, same pl. and fig. [Given as *Truncatulina* in descr. of plate.]

——— [**pygmæa**, Hantk.]. Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 216, viii, 13.

——— **repanda** (Fichtel & Moll), (varr.). Parker & Jones, Phil. Trans. 1865, 390, xiv, 12–17, xvi, 35–51. [*Nautilus*, 1798.]

——— ——— ——— v. **elegans** (d'O.). Parker & Jones, Phil. Trans. 1865, 397, xvi, 44–46. [*Rotalia*, 1826.]

——— ——— ——— v. **karsteni** (Rss.). Parker & Jones, Phil. Trans. 1865, 396, xiv, 14, 15, and 17, xv, 38–40. [*Rotalia*, 1855.]

——— ——— ——— v. **menardii** (d'O.). Parker & Jones, Phil. Trans. 1865, 394, xvi, 35–37. [*Rotalia*, 1826.]

——— ——— ——— v. **menardii** (d'O.), subv. **canariensis** (d'O.). Parker & Jones, Phil. Trans. 1865, 395, xvi, 47–49. [*Rotalina*, 1839.]

——— ——— ——— v. **menardii** (d'O.), subv. **micheliniana** (d'O.). Parker & Jones, Phil. Trans. 1865, 396, xiv, 16, xvi, 41–43. [*Rotalina*, 1840.]

——— ——— ——— v. **menardii** (d'O.), subv. **pauperata**, Parker & Jones. Phil. Trans. 1865, 395, xvi, 50, 51*a*, 51*b*. [See *P. pauperata*.]

PULVINULINA terquemi, Schwager. Palaeontographica, xxx, 1883, Pal. Theil, 134, xxviii (5), *3a–d*.

——— **trochiformis**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 216, viii, 14.

——— **truncatulinoides** (d'Orbigny). Parker & Jones, Phil. Trans. 1865, 398, xvi, 41–43. [*Rotalina*, 1839.]

——— **tumida**, Brady. Report Challenger, 1884, 692, ciii, 4–6. [*P. menardii*, var. 1877.]

——— **umbilicata** (d'Orb.). Jones, Geologist, VI, 1863, 294 and 432, xv, 9–11. [*Rotalina*, 1840.]

——— **umbilicata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), not descr., xv, 9 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), same pl. and fig. [Given as *Discorb. disca* in German text, 76.]

——— **umbonata**, Reuss. Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 67, ix, 8 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 77, same pl. and fig. [*Rotalina*, 1851.]

——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 200, iv, 45, 46.

——— ——— ——— Brady, Report Challenger, 1884, 695, cv, *2a, b, c*.

——— **vermiculata** (d'Orbigny). Carpenter, Parker, & Jones, Introd. Foram. 1862, 211, xiii, 4–6. [*Planorbulina*, 1826.] [Structural.]

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 178, xii, 146.

——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 207, ix, 5.

——— [**vermicularis**] ——— Jones, in Microgr. Dict. ed. 4, 1883, 648, xxiv, 11.

——— ——— ——— Brady, Report Challenger, 1884, 687, cxv, *2a, b*.

——— see *Eponides*.

———? see *Jesites*.

——— see *Nautilus*.

PULVINULUS, Lamarck, 1816.

——— **asterisans** [F. & M.]. Lamarck, Ency. Method., "Vers," (1830), n. d., 466, f. 10 (pls. 1827), (P. & J. quote pt. 23, 1816).

——— **repandus** [F. & M.]. Lamarck, Ency. Method., "Vers," (1830), n. d., 466, f. 9 (pls. 1827), (P. & J. quote pt. 23, 1816).

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, viii, 46*AA*, *BB*. [= *Gyroidina orbicularis*.]

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, viii, 46*CC*. [= *Nodos. scalaris*, Batsch.]

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, viii, 46*DD*. [= *Gyroidina soldanii*.]

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, viii, 46*EE*. [= *Pulvinulina auricula*.]

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, vii, 46*XX*, *YY*. [= *Rotalia soldanii*, var.]

Pulvis ut supra, sed ex microscopicis prorsus Testis, etc. Soldani, Sagg. Oritt. 1780, 110, vii, 46*ZZ*. [= *Amphistegina lessoni*.]

PUPINA, d'Orbigny. Reuss, in Geinitz, Grundriss Verstein. 1845–1846, 646. [D'Orbigny, in De la Sagra's Hist. phys. Ile Cuba, 1839, "Foraminifères," 109, describes the genus *Chrysalidina ;* as the locality for his species is the same as that quoted by Reuss, and as only one species was known to d'Orbigny, it is fair to assume that *Pupina* was a misquotation.]

PUSTULARIA, Gray, 1858. Proc. Zool. Soc. London, XXVI, 1858, 271. [= *Polytrema*.]

——— **rosa**, Gray. Proc. Zool. Soc. London, XXVI, 1858, 271, not fig'd. [= *Polytrema miniaceum*.]

* Given by d'Orbigny as a subgenus of *Polymorphina.*

QUINQUELOCULINA akneriana, d'Orbigny. Foram. Fossiles Vienne, 1846, 290, xviii, 16–21. [See *Miliolina.*]
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 85, xii, 5*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— **alata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 38, vi, 2*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— **anguina**, Terq. Mém. Soc. géol. France, [3], I, 1878, 78, ix (xiv), 20*a–c*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 180, xix (xxvii), 20*a–c*.
——— **angularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 23.
——— **angulata**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 334, xxxvii, 13–18.
——— **angulata** (Will.). Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 40, vi, 13*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise). [See *Miliolina bicornis*, var.]
——— **angusta** (Phil.). Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 253, ix, 90. [*Triloculina*, 1843.]
——— **angustidentata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 175, xviii (xxvi), 26–28.
——— **angustissima**, Rss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 384, xlix, 18.
——— **annularis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 180, xix (xxvii), 17*a–c*.
——— **antillarum**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 194, xii, 4–7 [error for 4–6]; also in Spanish, 1840, 167, same pl. and fig.
——— **araucana**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 76, ix, 13–15.
——— **arenosa**, Terquem. Mém. Soc. géol. France, [3], IV, 1886, 87, x, 19–41.
——— **argus**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 374.
——— **ariminensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 16.
——— **aspera**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 11.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 65, vi (xi), 11*a–c*.
——— ——— ——— = *Q. seminulum* (Linn.); see *Frumentaria seminula*.
——— **asperula**, Seguenza. Atti Accad. Gioenia Sci. Nat. [2], XVIII, 1862, 120, ii, 6, 6*a* and 6*b*.
——— ——— ——— Schwager, Novara-Exped., Geol. Theil II, 1866, 203, iv, 16*a*, *b*, *c*.
——— **atropos**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 152, iii, 6.
——— **auberiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 193, xii, 1–3; also in Spanish, 1840, 167, same pl. and fig. [See *Miliolina.*]
——— **badenensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 299, xx, 10–12.
——— **bajociana**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 499, xvii, 24.
——— **berthelotiana**, d'Orbigny. Barker, Webb, & Berthelot, Hist. Nat. Iles Canaries, 1839, ii, pt. 2, "Foraminifères," 142, iii, 25–27.
——— **bicarinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 35.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 68, vii (xii), 10*a–c*.
——— **bicarinella**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 456, i, 6*a–c*.
——— **bicornis** (Walk.). Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 39, vi, 6*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise). [*Serpula*, 1798.]
——— ——— ——— v. **elegans**, Will. Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 39, vi, 7*a*, *b*; (and Mém. Soc. Dunkerquoise). [See *Miliolina bicornis*, var.]

QUINQUELOCULINA bicostata, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 195, xii, 8–10 ; also in Spanish, 1840, 168, same pl. and fig.

——— **bidentata**, d'Orb. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 197, xii, 18–20 ; also in Spanish, 1840, 169, same pl. and fig.

——— **biondi**, Seguenza. Atti Accad. Gioenia Sci. Nat. [2], XVIII, 1862, 119, ii, 7, *7a* and *7b*.

——— **birostris** (Lam.). Terquem, Mém. Soc. géol. France, [3], II, 1882, 181, xix (xxvii), *23a, b*. [*Miliolites*, 1804.]

——— **bistorta**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 78, ix (xiv), *21a–c*.

——— **bosciana**, d'Orb. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 191, xi, 22–24 ; also in Spanish, 1840, 165, same pl. and fig.

——— **boueana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 293, xix, 7–9. [See *Miliolina*.]

——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 329, xxv, *15A, B, C*.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 84, xii, *1a, b, c*; (and Mém. Soc. Dunkerquoise).

——— **brauni**, Reuss. Neues Jahrbuch, 1853, 674, ix, 4.

——— **brongniartii**, d'Orb. J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, 14, iii, 41 and 42, iv, 2. [*Triloculina*, 1826.]

——— ——— ——— Jones, in Micrgr. Dict. ed. 4, 1883, 651, xxiii, *6a, b*.

——— **bronniana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 287, xviii, 4–6.

——— **buchiana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 289, xviii, 10–12.

——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 327, xxvi, *7A, B, C*.

——— **bulloides**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 9.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 66, vi (xi), *17a–19c*.

——— **canaliculata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 74, viii (xiii), *23a–c*.

——— **candeiana**, d'Orb. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 199, xii, 24–26 ; also in Spanish, 1840, 170, same pl. and fig.

——— ——— ——— Brady, Ann. Mag. Nat. Hist. [4], VI, 1870, 286, xi, *1a, b*.

——— **carinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 28.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, viii (xxvi), 16 and 17.

? ——— **caudata**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 374 and 376. [See *Spiroloc. caudata*.]

? ———? ——— ——— Ehr., Mikrogeologie, 1854, xxiii, 52. [= ?]

——— **centrata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 177, xix (xxvii), 3–5.

——— **clotho**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 146, ii, 5.

——— **cognata**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 350, xix, 7.

——— **compressa**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 85, vii (xvii), *11a, b*.

——— **concava**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 386, li, 2.

——— **concinna**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 384, l, 2.

——— **confusa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 42, ii, *8a–c*.

——— **conica**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 187, xx (xxviii), *22a–c*.

——— **contorta**, d'Orbigny. Foram. Fossiles Vienne, 1846, 298, xx, 4–6.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 81, xi, *4a, b, c*; (and Mém. Soc. Dunkerquoise).

——— [**contortus** ?], d'Orb. Balkwill & Millett, Journ. Micr. III, 1884, 24, i, 2.

QUINQUELOCULINA contraria, Terq. et Berth. Mém. Soc. géol. France, [2], x, 1875, 85, vii (xvii), 12*a*, *b*.
——— **cora**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 76, ix, 16–18.
——— **cor-anguinum** (Lamarck). Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 12 and 13. [*Miliolites*, 1804.]
——— **corrugata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, n. d., xxv, 14.
——— **costata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 3.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 63, vi (xi), 3*a*–5*c*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 183, xx (xxviii), 8 and 9.
——— **costata**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 362, iii, 4.
——— **crassa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 14.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 186, xx (xxviii), 20 and 21.
——— **crassicostata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 185, xx (xxviii), 14–17.
——— **cuvieriana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 190, xi, 19–21 ; also in Spanish, 1840, 164, same pl. and fig. [v. *Miliolina*.]
——— **denticulata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 325, xxv, 9*A*, *B*, *C* [error for 6].
——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 38.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 70, viii (xiii), 1–11.
——— **dilatata**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 192, xi, 28–30 ; also in Spanish, 1840, 166, same pl. and fig.
——— **dimidiata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 81, xi, 5*a*, *b*, *c* ; (and Mém. Soc. Dunkerquoise).
——— **disciformis** (Will.). Terquem, Mém. Soc. géol. France, [3], I, 1878, 73, viii (xiii), 22*a*–*c*. [v. *Miliolina seminulum*.]
——— ——— ——— var. Terquem, Ess. Anim. Plage Dunkerque, pt. 3, 1881, 135, xvii, 17*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— **disparilis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 21.
——— **disticha**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 183, xx (xxviii), 7*a*–*c*.
——— **dubia**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 303, No. 47.
——— **dutemplei**, d'Orbigny. Foram. Fossiles Vienne, 1846, 294, xix, 10–12.
——— ——— ——— Harting, Magt van het Kleine, 1849, iii, fig. 6 ; German by Dr. A. Schwartzkopf, 1851, 81.
——— **eborea**, Schwager. Novara-Exped., Geol. Theil II, 1866, 204, iv, 18*a*, *b*, *c*.
——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 12.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 64, vi (xi), 7*a*–9*c*.
——— **enoplostoma**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 196, xii, 14–17 ; also in Spanish, 1840, 169, same pl. and fig.
——— **eos**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 457, i, 7*a*–*c*.
——— **ermani**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 351, xix, 6.
——— ——— ——— v. **trigonostomea**, Franzenau. Földtani Közlöny, XI, 1881, 45 and 98, iii, 10–12.
——— **excavata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 148, ii, 9.
——— **fabularoides**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 704, i, 3.
——— **falcifera**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 151, iii, 3.

QUINQUELOCULINA impressa, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 331, xxxvi, 2–7.

——— **inæqualis**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 142, iii, 28–30. [*Q. inæquerlis* on plate.]

——— **inca**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 75, iv, 20–22.

——— **incerta**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 178, xix (xxvii), 12*a–c*.

——— **inconstans**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 333, xxxvi, 18–20, xxxvii, 1–12.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 77, ix (xiv), 15–19.

——— **incrassata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 148, ii, 10.

——— **inflata**, d'Orbigny. P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 249, viii, 16. [*Triloculina*, 1826.]

——— **instabilis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 177, xix (xxvii), 6–11.

——— **intricata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 73, viii (xiii), 16*a*–21*b*.

——— **involuta**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 76, ix (xiv), 10*a–c*.

——— **irregularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 25.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 66, vi (xi), 15*a*–16*c*.

——— **isabellei**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 74, iv, 17–19.

——— **italica**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 69, vii (xii), 17*a*–20*c*.

——— **josephina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 297, xix, 25–27.

——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 321, xxv, 4*A*, *B*, *C*, *D*.

——— **juleana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 298, xx, 1–3.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 40, vi, 9*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).

——— **klipsteini**, Reuss. Neues Jahrbuch, 1853, 674, ix, 6.

——— **kostejana**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 152, iii, 4.

——— **krenneri**, Franzenau. Földtani Közlöny, XI, 1881, 46 and 98, iii, 13–18.

——— **lachesis**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 146, ii, 4.

——— **lacunosa**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 362, iii, 6.

——— **ladidorsata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 386, L, 12.

——— **lævigata**, Deshayes. Descr. Coq. Charact. 1831, 252 and 259, iii, 3 and 4.

——— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 6.

——— ——— ——— Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 143, iii, 31–33.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 173, xviii (xxvi), 14, 15.

——— **lamarckiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 189, xi, 14 and 15; also in Spanish, 1840, 164, same pl. and fig.

——— **lamellata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 39.

——— **lamellidens**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 41, i, 7*a–c*.

——— **lanceolata**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 84, vii (xvii), 7*a*, *b*.

QUINQUELOCULINA oculus, d'Orbigny. Terquem, Mém. Soc. géol. France, [3], I, 1878, 65, vi (xi), 12*a–c*.
——— **opaca**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 42, ii, 9*a–c*.
——— **opposita** (Lam.). Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 20. [*Miliolites*, 1804.]
——— **orbicularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 37.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 86, xii, 9*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **ornatissima**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 151, iii, 2. [v. *Hauerina*.]
——— **ovalis**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 351, xix, 9.
——— **ovata**, Roemer. Neues Jahrbuch, 1838, 393, iii, 78.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 252, ix, 88.
——— **ovula**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 147, ii, 8.
——— **ovula**, Terquem. Quatr. Mém. Foram. Oolith. 1874, 332, xxxvi, 8–16.
——— ——— ——— Terq. & Berth., Mém. Soc. géol. France, [2], x, 1875, 85, vii (xvii), 8*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 76, ix (xiv), 9*a–c*.
——— **parasitica**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 78, ix (xiv), 22*a–c*.
——— **parisiensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 5.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 181, xix (xxvii), 21*a–c*.
——— **partschii**, d'Orbigny. Foram. Fossiles Vienne, 1846, 293, xix, 4–6.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 83, xi, 9*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— **patagonica**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 74, iv, 14–16.
——— **paucisulcata**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 452, i, 7.
——— **pauperata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 286, xvii, 22–24.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 40, vi, 11*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— **peregrina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 292, xix, 1–3.
——— ——— ——— v. **edentula**, Franzenau. Földtani Közlöny, XI, 1881, 45 and 97, iii, 4–6.
——— **pertusa**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 183, xx (xxviii), 5*a–c*.
——— **peruviana**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 73, iv, 1–3, 10–13.
——— **philippii**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 252, ix, 87.
——— **placenta**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 374.
——— **plana**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 8.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 83, xi, 11*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 63, vi (xi), 6*a–c*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 174, xviii (xxvi), 20 and 21.
——— **planciana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 186, x, 24 and 25, xi, 4–6; also in Spanish, 1840, 162, same pl. and figs.
——— **plicata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 179, xix (xxvii), 14*a–c*.
——— **plicatella**, Reuss. See *plicatula*.
——— **plicatula**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 74, iii, 2*a–c*. [*plicatella* on plate.]

QUINQUELOCULINA rotundata, Terq. & Berth. Mém. Soc. géol. France, [2], x, 1875, 85, vii (xvii), 10*a*, *b*¹.
——— **rugosa**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 302, No. 24.
——— ——— ——— Schwager, Novara-Exped., Geol. Theil ii, 1866, 203, iv, 16*a*, *b*, *c*. [Referred to *Q. asperula*, Seg., in explan. to plate.]
——— **sagra**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 188, xi, 16–18 ; also in Spanish, 1840, 163, same pl. and fig.
——— **sancti-beati**, Rütimeyer. Nouv. Mém. Soc. Helvet. Sci. Nat. xi, 1850, Mém. 2, v, 62.
——— **sandbergeri**, Reuss. Neues Jahrbuch, 1853, 674, ix, 7.
——— **sarmatica**, Karrer. Abh. k. k. geol. Reichs. ix, 1877, 375, xvi, *a*, 11*a*, *b*, *c*.
——— ——— ——— v. **elongata**, Karrer. Abh. k. k. geol. Reichs. ix, 1877, 376, xvi, *a*, 11*b*.
——— ——— ——— v. **virgata**, Karrer. Abh. k. k. geol. Reichs. ix, 1877, 376, xvi, *a*, 11*c*.
——— **saxorum** (Lamarck). D'Orbigny, Ann. Sci. Nat. vii, 1826, 301, No. 1, xvi, 10–14. [*Miliolites*, 1804.]
——— ——— ——— D'Orbigny, Modèles, No. 33, 1826.
——— ——— [d'Orb.]. Cuvier, Règne Animal, 1836–46, ix (pls. x), 34, xiv, 7.
——— ——— [d'Orb. & Lam.]. Galeotti, Mém. Couronnés Ac. R. Bruxelles, xii, 1837, Mém. iii, 142, iii, 19.
——— ——— ——— Smedley, Ency. Metrop. 1845, undescr., pl. "Mollusca ?" 25–27.
——— ——— [d'Orb.]. Reuss, in Geinitz, Grundr. Verstein. 1845–46, 685, xxiv, 91.
——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, iii, 1853–56, 248, xxxv³, 6*a*–*d*.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1855, 169, iv, xx. [*? saxorum.*] [Glauc.]
——— ——— ——— Beudant, Géologie, ed. 8, 1858, 117, fig. 105 ; later eds., same fig.
——— ——— [d'Orb.]. P., J., & B. [d'O., Modèles, No. 33], Ann. Mag. Nat. Hist. [3], xvi, 1865, 24, i, 13.
——— ——— [d'Orb.]. Zittel, Handbuch Palaeont. Abth. i, 1876, 77, fig. 10⁴, and fig. 11².
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], ii, 1882, 181, xix (xxvii), 22*a*, *b*.
——— ——— [d'Orb.]. Hoernes, Elem. Palaeont. 1884, 35, fig. 33 ; French ed. 1886, same fig.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1061, lxxxvii, 12.
——— ——— ——— Steinmann, Elém. Paleont. i, 1888, 23, fig. 4*E*.
——— **schreibersii**, d'Orbigny. Foram. Fossiles Vienne, 1846, 296, xix, 22–24. [v. *Miliola*.]
——— [**schreibersi**] ——— Suess, Boden Stadt Wien, 1862, 45, fig. 1⁶.
——— **schroekingerii**, Karrer. Sitz. k. Ak. Wiss. Wien, lviii, Abth. 1, 1868, 149, ii, 12.
——— ——— ——— v. **calabra**, Seguenza. Atti R. Acc. Lincei, [3], vi, 1880, 154, xiv, 14*a*, *b* [error for 13].
——— **scidula**, Karrer. Sitz. k. Ak. Wiss. Wien, lv, Abth. 1, 1867, 361, iii, 1.
——— **sclerotica**, Karrer. Sitz. k. Ak. Wiss. Wien, lviii, Abth. 1, 1868, 152, iii, 5. [v. *Miliolina*.]
——— **secans**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 303, No. 43. [See *Miliolina*.]
——— ——— ——— D'Orbigny, Modèles, No. 96, 1826.
——— ——— ——— Bronn, Lethaea Geognostica, ed. 2, 1837, 1146, xlii, 32*a*–*c*.
——— ——— ——— Roemer, Neues Jahrbuch, 1838, 393, iii, 77.

QUINQUELOCULINA secans, d'Orbigny. Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 247, xlii, 32*a*, *b*, *c*.

——— ——— ——— P., J., & B. [d'O., Modèles, No. 96], Ann. Mag. Nat. Hist. [3], XVI, 1865, 34, i, 10.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 250, viii, 14.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 250, viii, 15. [*Q. vulgaris*, d'O., q. v.]

——— **[seccans]** ——— Karrer, in v. Drasche, Frag. Geol. Luzon, 1878, 88, v, 7 ; and Bol. Com. Mapa Geol. Españ. VII, 1880, 270*E*, 7.

——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 189, iv, 11.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.

——— ——— ——— See *Frumentaria seminula*, and *F.* 2 *speciei.*

——— **semilunaris**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 134, xvii, 14*a*, *b*, *c* ; (and Mém. Soc. Dunkerquoise).

——— **semilunum** (Linn.). Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 86, xii, 10*a*, *b* ; (and Mém. Soc. Dunkerquoise). [Misprint for *seminulum.*]

——— **seminuda**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 125, i, 11.

——— **seminuda**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 76, ix (xiv), 8*a*–*c*.

——— **seminulum** (Linné). See *Serpula*, 1758.

——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 303, No. 44.

——— ——— ——— G. B. Sowerby, Foram. Colne Tidal River, 1856 [privately printed], plate, fig. 8 and 9 [also 10].

——— ——— ——— Parker & Jones, Ann. Mag. Nat. Hist. [2], XIX, 1857, 300, x, 34-36.

——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, 9, iii, 35 and 36.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 250, viii, 10.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 250, viii, 11. [*Q. aspera*, d'O., q. v.]

——— ——— ——— (young) ? P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 251, viii, 12. [*Adelos. lævigata*, d'O., q. v.]

——— ——— ——— (young) ? P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 252, viii, 13. [*Adelos. semistriata*, d'O., q. v.]

——— ——— ——— Dawson, Canad. Nat. VI, 1872, 256, iii, 2.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 40, vi, 8*a*, *b* ; (and Mém. Soc. Dunkerquoise).

——— ——— ——— Nicholson, Manual Palaeont. 1879, i, 108, fig. 18*b*.

——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 651, xxiii, 5*a*, *b*.

——— ——— ——— Dawson, Handbook Zoology, ed. 3, 1886, 43, fig. 30.

——— ——— ———? See *Frumentaria seminula*, and *F.* 3 *speciei.*

——— **semi-ornata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 82, xi, 6*a*, *b*, *c* ; (and Mém. Soc. Dunkerquoise).

——— **semiplana**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 275, x, 1.

——— **semistriata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 13.

——— **signata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 385, l, 11.

——— **simplex**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 172, xviii (xxvi), 5-13.

——— **sinuosa**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 72, viii (xiii), 12*a*–15*c*.

——— **soldanii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 303, No. 48.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 251, viii, 17.

——— ——— ——— See *Frumentaria seminula.*

——— **speciosa**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 251, viii, 86.

QUINQUELOCULINA stelligera, Terquem. Mém. Soc. géol. France, [3], II, 1882, 183, xx (xxviii), 6*a–c*.

——— **striata**, Deshayes. In Lyell, Principles of Geology, III, 1833, 251, iv, 5–8.

——— **striata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 4.

——— ——— ——— Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 10, iii, 10.

——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 19, vi, 9.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 184, xx (xxviii), 10–12.

——— **striatella**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 328, xxvi, 3*A*, *B*, *C*.

——— **striatopunctata**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 362, iii, 5.

——— **striatula**, Deshayes. Descr. Coq. Charact. 1831, 252 and 259, iii, 1 and 2.

——— ——— ——— Brown, Elem. Foss. Conch. 1843, 24, ii, 21.

——— **striolata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 385, l, 10.

——— **subaffinis**, Eichwald. Lethaea Rossica, III, 1853, 13, i, 16*a–d*.

——— **subangulata**, Roemer. Neues Jahrbuch, 1838, 394, iii, 80.

——— **subcarinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 10.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 64, vi (xi), 10*a–c*.

——— **suborbicularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 29.

——— **subrotunda** (Mont.). D'Orbigny, Ann. Sci. Nat. VII, 1826, 302, No. 36. [*Vermiculum*, 1803.]

——— ——— ——— Gosse, Manual Mar. Zool. 1855, 14, fig. 18.

——— ——— ——— Brady, Nat. Hist. Trans. Northumb. I, 1865–67 (1867), 94, xii, 2.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 39, vi, 4 ; (and Mém. Soc. Dunkerquoise).

——— ——— [d'Orb.]. Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 85, xii, 7*a*, *b* ; (and Mém. Soc. Dunkerquoise).

——— **sulcata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 301, No. 17.

——— **sulcifera**, Roemer. Neues Jahrbuch, 1838, 393, iii, 76.

——— **suturalis**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 385, l, 9.

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 76, iii, 1*a–c*.

——— **tenuis**, Czjzek. Haidinger's Nat. Abh. II, 1848, 149, xiii, 31–34. [v. *Spiroloculina* ; *Miliola* ; and *Miliolina*.]

——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, I, 1850, 385, l, 8.

——— ——— ——— Reuss, Zeitschr. deutsch. geol. Ges. III, 1851, 87, vii, 60.

——— **tetragona**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 74, ix (xiv), 3*a–c*.

——— **transilvaniæ**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 704, i, 4.

——— **transvera**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 324, xxvi, 9*A*, *B*, *C*.

——— **trapezoidalis**, Terq. et Berth. Mém. Soc. géol. France, [2], x, 1875, 85, vii (xvii), 9.

——— **triangularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 302, No. 34. [v. *Miliola*.]

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 288, xviii, 7–9.

——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, 10, iv, 1.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 83, xi, 10*a*, *b*, *c* ; (and Mém. Soc. Dunkerquoise).

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], I, 1878, 67, vii (xii), 1*a–9c*.

QUINQUELOCULINA sp., d'Orb. Reuss' Models, No. 99, 1865 (Catal., No. 20, 1861).
——— v. Schlicht, Foram. Septar. Pietzpuhl, 1870, plate xxxvi, xxxvii.
——— Terq. & Berth., Mém. Soc. géol. France, [2], x, 1875, 73, cuts 12–14. [Diagrams.]
——— Schlumberger, F. Jeun. Nat., Feb. 1882, ii, 12. [Showing young.]
——— de Folin, Congrès Scient. Dax, 1882 (1883), 310, pl., f. 7 and 8. [Sarcode body.]
——— de Folin, Le Naturaliste, ann. 9, 1887, 139, fig. 17*a*, *b*.
——— Steinmann, Elém. Paléont. I, 1888, 23, 4*D*.
——— Neumayr, Stämme d. Thierreiches, I, 1889 (1888), 178, fig. 20.
——— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 76, 77, viii, 44–51.
——— see under *Miliola* and *Miliolina*.

RAMULINA, Jones MS., 1875. Wright, Rept. Proc. Belfast Nat. F. Cl. 1873–74, App. III, 1875, 88 [90]; Brady, Report Challenger, 1884, 587.
——— **aculeata** (d'Orbigny). Wright, Proc. Belfast Nat. F. Cl. 1884–85, App. IX, 1886, 331, xxvii, 11. [*Dentalina*, 1840.]
——— **brachiata**, Jones MS. Wright, Rept. Proc. Belfast Nat. F. Cl. 1873–74, App. III, 1875, 88 [90], iii, 20.
——— **globulifera**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 272, viii, 32 and 33.
——— ——— ——— Brady, Report Challenger, 1884, 587, lxxvi, 22–28.
——— **lævis**, Jones MS. Wright, Rept. Proc. Belfast Nat. F. Cl. 1873–74, App. III, 1875, 88 [90], iii, 19.
——— **parasitica**, Carter. Ann. Mag. Nat. Hist. [6], IV, 1889, 94, viii.
——— sp. Balkwill & Millett, Journ. Micr. III, 1884, 83, iv, 7.
——— see "Flask-like objects."

RAPHANULINA, Zborzewski, 1834. Nouv. Mém. Soc. Imp. Nat. Moscou, III, 1834, 311.
——— **humboldtii**, Zborz. Nouv. Mém. Soc. Imp. Nat. Moscou, III, 1834, 311, xxviii, 1*a*. [= *Polymorphina gibba*.]

RECEPTACULITES, Defrance, 1827. Dict. Sci. Nat. XLV, 1827, 5. [For full synonymy of this genus of Siliceous Sponges, some members of which have occasionally been referred to the Foraminifera, see G. J. Hinde, Quart. Journ. Geol. Soc. XL, 1884, 795-840.

RENOIDEA, Brown, 1827.
——— **glabra**, Brown. Illustr. Conch. Great Britain, 1827, fly-leaf, i, 20 and 21. [*Serpula subrotundata* and *S. tenuis*, Walker & Boys.] [v. *Triloculina*.]
——— **marginata**, Brown. Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 25. [? a *Lagena*.]
——— **oblonga**, Brown. Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 16 and 17. [= *Polymorphina*.]
——— ——— ——— Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 3, lvi, 16 and 17.
——— **rotundata**, Brown. Illustr. Conch. Gt. Brit. 1827, fly-leaf, i, 14 and 15. [v. *Triloculina*.]
——— Given by Bütschli as synonym of *Biloculina*.

RENULINA, Lamarck, 1822. Hist. Anim. s. Vert. VII, 1822, 605.
——— **complanata** (Defrance). Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 371, vi, 2 [error for 4]. [*Frondicularia*, 1824.]
——— **opercularia**, Lamarck. Bronn, Syst. urweltl. Conchyl. 1824, 7, i, 9. [*Renulites*, 1804.]
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 371, vi, 3.
——— [**opercularis**] ——— Brown, Conch. Text-book, 1839, 63, x, 21.
——— [**opercularis**] ——— Brown, Elem. Foss. Conch. 1843, 24, ii, 34.
——— **sorbyana**, Blake. Month. Micros. Journ. XV, 1876, 262, cut. [An obscure organism ?]

REOPHAX nodulosa, Brady. Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 5, ii, 2*a*, *b*.
——— **pilulifera**, Brady. Report Challenger, 1884, 292, xxx, 18–20.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 217, xli, 5–8.
——— **polyeides**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 19, i, 2–2*c*.
[**RHEOPHAX**] ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [14], ii, 20, 20*a*, and 29.
——— **rudis**, Brady. Quart. Journ. Micr. Soc. XXI, 1881, 49. [This is the same as *R. sabulosa.*]
——— ——— ——— Carpenter, The Microscope, ed. 6, 1881, 564, fig. 321*a*, *b*.
——— **sabulosa**, Brady. Proc. Roy. Soc. Edinburgh, XI, 1882, 715.
——— ——— ——— Brady, Report Challenger, 1884, 298, xxxii, 5 and 6.
——— **scorpiurus**, Montfort. Conch. Syst. I, 1808, 331, 83d genre. [v. *Nodosaria ; Lituola ; L. nautiloidea*, var. ; *Lituolina.*]
——— ——— ——— Carpenter, The Microscope, ed. 6, 1881, 564, fig. 321*e*.
——— ——— ——— Haeusler, Quart. Journ. Geol. Soc. XXXIX, 1883, 27, ii, 7.
——— ——— ——— Brady, Report Challenger, 1884, 291, xxx, 12–17.
——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 328, xiii, 5*a* and 5*b*.
——— ——— ——— Haeusler, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 9, i, 9–16.
——— ——— ——— Anon., Sci. News, 4 May, 1888, 413, fig. 9.
——— ——— ——— Agassiz, Three Cruises " Blake," II, 1888, 163, fig. 495.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 217, xli, 10.
——— **soldanii**, Parker & Jones. [*Lituola*, 1860.]
——— (**Lit.**) **soldanii** [d'Orb.]. Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 199, v, 14.
——— **spiculifera**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 54, iv, 10–11.
——— ——— ——— Brady, Report Challenger, 1884, 295, xxxi, 16 and 17.
——— **variabilis**, Haeusler. Neues Jahrbuch, Beil. IV, Heft 1, 1885, 10, i, 8.
——— sp. ind. Haeusler, Neues Jahrbuch, 1883, i, 61, iv, 15.
——— sp. ind. Haeusler, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 10, i, 2–4.
——— (?) sp. Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 328, xiii, 9, and 22–24.
——— (**Haplostiche**). Neumayr, Stämme d. Thierreiches, 1889, i, 172, fig. 16.
? ——— Wisnioski, Jahrbuch k. k. Geol. Reichs. XXXVIII (1889), 695, xiii, 65, 66.
——— De Folin, Bull. Soc. N. H. Toulouse, XV, 1881, 137 ; 9 new species proposed but not described !
REOPHAXOPSIS elegans, de Folin. Le Naturaliste, IX, 1887, 128, fig. 14.
Retolia, Haeusler, misprint in quoting Williamson, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 28. [v. *Rotalina.*]
RETORTA, Walker & Boys, 1784. Test. Min. rar. 1784, 3. [=*Adelosina ; see Serpula* (*Retorta*).]
REUSSIA (**Verneuilina** aut.) **spinulosa** (Reuss). Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 66.
RHABDAMMINA, M. Sars, 1868. Forh. Vidensk.-Selsk. Christiania, 1868 (1869), 248 ; Brady, Report Challenger, 1884, 266. [See Haeckel's remarks under *Astrorhizidæ.*]
——— **abyssorum**, M. Sars. Forh. Vidensk.-Selsk. Christiania, 1868 (1869), 248.
——— ——— ——— Carpenter, The Microscope, ed. 6, 1881, 562, fig. 321*c*, *d*.
——— ——— ——— v. **robusta**, Goës. K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 143, xii, 430 and 431.
——— ——— ——— Brady, Report Challenger, 1884, 266, xxi, 1–13.

RHABDOGONIUM liasinum, Berthelin. Revue et Mag. zool. 1879, 35, i, 18 and 19.

——— **martensi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 56, v, 4*a*, *b*.

——— ——— ——— Reuss' Models, No. 50, 1865 (Catal., No. 50, 1861).

——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1050, lxxxvi, 10.

——— **minutum**, Reuss. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 84, v, 4*a–c*, 5*a*, *b*.

——— ——— ——— Brady, Report Challenger, 1884, 526, lxvii, 4–6.

——— **pygmæum**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 138, ii, 32.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 22, i, 8 ; (and Mém. Soc. Dunkerquoise).

——— **pyramidale**, Karrer. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 444, i, 5.

——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 25, pl., 5.

——— **roemeri**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 201, vi, 7.

——— **strombecki**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 56, v, 3*a*, *b*.

——— **szaboi**, Hantken. Magyar. földt. társ. Munkálatai, IV, 1868, 90, i, 18*a*, *b*, *c*.

——— **tricarinatum** (d'Orbigny). Brady, Report Challenger, 1884, 525, lxvii, 1–3. [v. *Vaginulina*, 1826.]

? ——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 344, xii, 17 and 18.

——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 752, xv, 16*a*, *b*.

——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 223, xlv, 3.

RHABDOPLEURA. A genus of polyzoan molluscs [Ray Lankester, Nature, Sept. 14, 1882, 478]. Dawson's sp. is considered by Brady to belong to the Foraminifer *Rhabdammina*.

? ——— G. M. Dawson, Canad. Nat., n. s., v, 1870, 177, fig. 7. [= *Rhabdammina discreta*, Brady, 1884.]

——— **abyssorum**, G. M. Dawson. Amer. Journ. Sci. [3], I, 1871, 206, fig. 7 ; and Ann. Mag. Nat. Hist. [4], VII, 1871, 86, fig. 7. [= *Rhabdamm. discreta*, Brady.]

RHAPHIDODENDRON, Möbius, 1876. Beilage Tagebl. 49 Vers. deutsch. Naturfor. Hamburg, 1876, 115.

——— **album**, Möbius. Beilage Tagebl. 49 Vers. deutsch. Naturfor. Hamburg, 1876, 115, no fig.

RHAPHIDOHELIX, Möbius, 1880. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 76.

——— **elegans**, Möbius. Beitr. Meeresfauna Insel Mauritius, etc. 1880, 76, ii, 2.

RHEOPHAX, see *Reophax*.

RHINOCURUS, Montfort, 1808. Conch. Syst. I, 1808, 235.

——— **araneosus**, Montfort. Conch. Syst. I, 1808, 235, 59th genre. [= *Crist. calcar.*]

RHIPIDOCYCLINA, Gümbel, 1868. Abh. k.-bayer. Ak. Wiss. X, Abth. 2, 1868 (1870), 688. This subgenus of *Orbitoides* was proposed by Gümbel for the following forms : *O. nummulitica*, Gümbel ; *O. multiplicata*, Gümbel ; *O. strophiolata*, Gümbel ; *O. karakaiensis* (d'Archiac).

RHIZAMMINA, Brady, 1879. Quart. Journ. Micr. Sci. XIX, 1879, 39 ; Brady, Report Challenger, 1884, 274. [See Haeckel's remarks under *Astrorhiza.*]

——— **algæformis**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 39, iv, 16 and 17.

——— ——— ——— Brady, Report Challenger, 1884, 274, xxviii, 1–11.

RHIZAMMINA indivisa, Brady. Report Challenger, 1884, 277, xxix, 5–7.

RHIZOPELA, de Folin, 1881. Bull. Soc. N. H. Toulouse, XV, 1881, 140, not described, 1 sp. proposed.

RHYNCHOSPIRA, Ehrenberg, 1845. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 358. [See Brady, Report Challenger, 1884, 383 and 589.]

——— **abnormis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 60, vii, 17–19; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 69, same pl. and fig.

——— **glomerata** (Rss.). See *Globigerina*.

——— **indica**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 376.

RIMULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 257.

——— **bicaudata**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 119, i, 11*A*, *B*, *C*. [?]

——— **glabra**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 1.

——— ——— ——— D'Orbigny, Modèles, No. 53, 1826.

——— ——— ——— D'Orbigny, Foraminif. Fossiles Vienne, 1846, 63, xxi, 5 and 6.

——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 160, xii, 4.

——— ——— ——— Reuss' Models, No. 51, 1865 (Catal., No. 45, 1861).

——— ——— ——— P., J., & B. [d'O., Modèles, No. 53], Ann. Mag. Nat. Hist. [3], XVI, 1865, 27, i, 37.

——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 198, vii, 24.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.

——— **ventricosa**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 177, xiii, 11*a*, *A*.

ROBERTINA, d'Orbigny, 1846. Foram. Fossiles Vienne, 1846, 202.

——— **arctica**, d'Orbigny. Foram. Fossiles Vienne, 1846, 203, xxi, 37 and 38.

——— ——— ——— Schwager, Boll. R. Com. Geol. Ital. VIII, 1877, 26, pl., 69.

——— ——— ——— Schlumberger, F. Jeun. Nat., Feb. 1882, ii, 2.

——— **austriaca**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 375, xlvii, 15.

ROBULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 287.

——— **acknerana**, Neugeboren. Arch. Ver. siebenburg. Landeskunde, N. F. X, Heft 2, 1872, 288, iii, 17 and 18.

——— **aculeata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 289, No. 14.

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 664, xxiv, 36.

——— ——— ——— = *Crist. calcar* (Linn.). See *Nautili carinati*, etc.

——— **acutiangulata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 430, x, 19 [20] *a*, *b*.

——— ——— ——— var. **alta**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 50, ii, 17, 17*a*.

——— **acutimargo**, Reuss. Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 640, ii, 76bis, *a*, *b* [76*a* and *b*, by error in descr. to plate]. [Reuss' sp. is *angustimargo*, q. v.]

——— **alato-limbata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 641, ii, 70*a*, *b*.

——— **ambigua**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xx, 17.

——— **angulata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 154, viii, 6. [v. *Cristellaria*.]

——— **angustimargo**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 67, iv, 22.

——— ——— ——— Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 332, xiv, 6 and 7 [and 10 ? young form].

——— **antigua**, Michelotti. Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III, (2), 1847, 14, i, 2.

——— **arcuata**, Karrer. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 446, ii, 1.

ROBULINA arcuato-striata, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 48, vii, 2 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 56, same pl. and fig.

——— **ariminensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 289, No. 15. [v. *Cristellaria*.]

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 95, iv, 8 and 9.

——— ——— ——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 70, vi, 10*a*, *b*.

——— ——— ——— Mackie, Science Gossip, 1867, 130, fig. 125.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxix, 10*a*, *b*. [= *Crist. costata*, F. & M., var.]

——— **armata**, Neugeboren. Arch. Ver. siebenburg. Landeskunde, N. F. X, Heft 2, 1872, 282, ii, 6 and 7.

——— **articulata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 53, v, 62*a*, *b*, vi, 63*a*, *b*. [v. *Cristellaria*.]

——— **austriaca**, d'Orbigny. Foram. Fossiles Vienne, 1846, 103, v, 1 and 2.

——— ——— ——— Costa, Mem. Acc. Sci. Napoli, II, 1855 (1857), 122, i, 10*A*, *B*, *C*.

——— ——— ——— Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F. X, Heft 2, 1872, 286, iii, 7 and 8.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 70, vii, 20*a*, *b* ; (and Mém. Soc. Dunkerquoise).

——— **baconica**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 49, xiv, 9 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 58, same pl. and fig.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 17.

——— **badensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 37, iv, Geissberger Schicht, 2.

——— **beyrichi**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 332, xiv, 8 and 9 [? young form]. [v. *Cristellaria*.]

——— **budensis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 49, vii, 1 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 58, same pl. and fig.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 5.

——— **bullata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 49, xiv, 13 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 58, same pl. and fig.

——— **calcar** (Linné). v. *Nautilus*, 1758 ; and *Cristellaria*.

——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 289, No. 12.

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 292, ii, 6.

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 99, iv, 18–20.

——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 195, x, 12*a*, *A*, *C*, xvii, 2*a*, *A*.

——— ——— [d'Orb.]. Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F. X, Heft 2, 1872, 282, ii, 5.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 16.

——— ——— [d'Orb.]. Schlumberger, F. Jeun. Nat., Jan. 1882, i, 9.

——— ——— [d'Orb.]. Hoernes, Elem. Palaeont. 1884, 28, fig. 19 ; French ed. 1886, same fig.

——— ——— ——— = *Crist. rostrata* (Montf.) ; see *Nautilus papillosus*.

——— **canariensis**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 127, iii, 3 and 4.

——— ——— ——— Mackie, Science Gossip, 1867, 130, fig. 123.

——— **cancellata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 230, xix, 5*A*, *B*.

——— **carinata**, Dunikowski. Kosmos [Lemberg], IV, 1879, 128, plate, 21.

? ——— **caspia**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), xii, 6.

——— **centrata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 70, vii, 19 ; (and Mém. Soc. Dunkerquoise).

ROBULINA clypeiformis, d'Orbigny. Foram. Fossiles Vienne, 1846, 101, iv, 23 and 24.

——— ——— ——— var. **festonata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 196, x, 37*A*, *B*, *C* [error for 11], xix, 1.

——— **compressa**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 338, xv, 17.

——— **compressa**, Egger. Neues Jahrbuch, 1857, 297, xiv, 12 and 13.

——— **compressa**, Neugeboren. Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 280, ii, 1–4.

——— **comptoni** (Sowerby). Roemer, Verst. norddeutsch. Kreide, 1840–41, 99, xv, 34. [v. *Nautilus.*]

——— **concinna**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 52, v, 58*a*, *b*.

——— **confusa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 142, xiii, 21, 21*a*.

——— **corona-lunæ**, Stache. Novara-Exped., Geol. Theil I, 1864, 250, xxiii, 29*a*, *b*.

——— **crassa**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 98, xv, 32.

——— **crenata**, Hagenow. Neues Jahrb. f. Min. 1842, 572.

——— **cristellina**, Ehrenberg. Mikrogeologie, 1854, xx, ii, 24. [= *C. rotulata.*]

——— **cultrata**, de Montfort. D'Orbigny, Ann. Sci. Nat. VII, 1826, 287, No. 1; and d'Orbigny, Modèles, No. 82, 1826. [*Robulus*, 1808.]

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 291, ii, 5.

——— ———? ——— Pilla, Distinz. terr. Etrurio, 1846, 104, i, 9.

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 96, iv, 10–13.

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 207, xxxv^2, 9*a*, *b*.

——— ——— [d'Orb.] var. **antipodum**, Stache. Novara-Exped., Geol. Theil I, 1864, 251, xxiii, 30*a*, *b*.

——— ——— ——— P., J., & B. [d'O., Modèles, No. 82], Ann. Mag. Nat. Hist. [3], XVI, 1865, 32, i, 39.

——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.

——— ——— ——— = *Crist.*, see *Nautili* (*Lenticulæ marginatæ*); and *Nautilus circumalati*, etc.; and *Naut. lævi-lucido*, etc.

——— **cummingii**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 292, ii, 4.

——— ——— ——— Michelotti, Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III, (2), 1847, 14, i, 3.

——— ——— ——— Bornemann, Zeitschr. deutsch. geol. Ges. XII, 1860, 156, vi, 1*a*, *b*.

——— **curvicosta**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 144, xiii, 31 and 31*a*.

——— **curvisepta**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 142, xiii, 20, 20*a*.

——— **curvispira**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 144, xiii, 28*a*–*c*.

——— **declivis**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 333, xv, 11.

——— ——— ——— Gümbel, Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 640, ii, 76*a*, *b* [76 bis, *a* and *b* by error in descr. to plate].

——— **deformis**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 70, iv, 30. [v. *Cristellaria.*]

——— ——— ——— Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 337, xiv, 1–3.

——— ——— ——— Reuss' Models, No. 33, 1865 (Catal., No. 63, 1861). [= 1st stage of *C. rotulata.*]

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 53, v, 60*a*, *b*, 61*a*, *b*.

? ——— **denaria**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 39. [= *Crist. rotulata.*]

——— **depauperata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 70, iv, 29.

ROBULINA depauperata, Reuss. Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 337, xiv, 11.

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 54, vi, 67*a*, *b*, 68*a*, *b*.

——— ——— ——— Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 287, iii, 9 and 10.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 47, vi, 5 and 6, xiv, 16 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 55, same pl. and fig.

——— **depressa**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 291, ii, 3.

——— ——— ——— Michelotti, Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III, (2), 1847, 15, i, 1.

——— ——— ——— Abich, Mém. Ac. Imp. Sci. [Math. Phys.] St. Pétersbourg, [6], VII, 1859, 104, ix, 4.

——— **dilecta**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 145, xiii, 33 and 33*a*.

——— **dimorpha**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 67, iv, 23.

——— **discoides**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 290, No. 18.

——— **discrepans**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 78, ix, 7*a*, *b*.

——— **d'orbignii**, Bailey. Smithsonian Contrib. II, 1851, 10, pl., 9 and 10.

——— **dubia**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 144, xiii, 30 and 30*a*.

——— **echinata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 100, iv, 21 and 22. [v. *Cristellaria*.]

——— ——— ——— Czjzek, Haidinger's Naturw. Abh. II, 1848, 141, xii, 24 and 25.

——— ——— ——— D'Orbigny, Cours élém. Paléont. etc. I, 1849, 196, fig. 320 ; II, fas. 2, 1852, 818, fig. 623.

——— ——— ——— Mackie, Science Gossip, 1867, 130, fig. 126.

——— **ehrenbergii**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 98, xv, 31.

——— **eichbergensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 29, iii, 38.

——— **elegantissima**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 198, xix, 4.

——— **ferruginea**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 496, xvii, 11*a*, *b*, *c*.

——— **florigemma**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 644, i, 75.

——— **foliata**, Stache. Novara-Exped., Geol. Theil I, 1864, 245, xxiii, 24*a*, *b*.

——— **formosissima**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 145, xiii, 32, 32*a*.

——— **galeata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 67, iv, 21.

——— **gibba**, Roemer. Verstein. norddeutsch. Oolith., Nachtrag, 1839, 47, xx, 30.

——— **glauca**, Coppi. Boll. R. Com. geol. Ital. VII, 1876, 208, no fig.

——— **glauca**, Doderlein MS. Malagoli, Atti Sci. Nat. Modena, Mem. [3], VII, 1888, 4, i, 3, 4, and 5.

——— **granulata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 49, xiv, 15 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 57, same pl. and fig.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxix, 7.

——— **gravida**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 142, xiii, 23*a*–*f*.

——— **goniaphora**, Neugeboren. See *R. goniphora*.

——— **goniphora**, Neugeboren. Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 289, iii, 19 and 20. [*goniaphora*, on plate.]

——— **gottingensis**, Bornemann. Lias von Göttingen, 1854, 43, iv, 40, 41*a*, *b*.

——— **gutticostata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 643, i, 74.

ROBULINA lepida, Reuss. Verstein. böhm. Kreide, 1845–46, ii, 109, xxiv, 46. [v. *Cristellaria.*]

——— **lepsii**, Schopp. Abh. Hess. geol. Landes. Darmstadt, I, (3), 1889, 380, i, 1.

——— **liasina**, Terquem. Mém. Ac. Imp. Metz, XLII, 1862, 449, vi, 9*a*, *b*.

——— **limbata**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 335, xv, 4, 5, and 6.

——— cfr. ——— ——— Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 336, xv, 7.

——— **limbosa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. I, 1863 (1864), 55, vi, 69*a*, *b*.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 48, vi, 11; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 57, same pl. and fig.

——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 14*a*, *b*. [= *Crist. cultrata*, Montf.]

——— **lobata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xx, 14.

——— **loculosa**, Stache. Novara-Exped., Geol. Theil I, 1864, 244, xxii [error for xxiii], 23*a*, *b*.

——— **lucida**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 142, xiii, 19 and 19*a*.

——— **magdeburgica** (Phil.). Bornemann, Zeitschr. deutsch. geol. Ges. XII, 1860, 157, vi, 2*a*, *b*. [*Nonionina*, 1851.]

——— **marginata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 288 and 290, Nos. 6 and 19. [v. *Cristellaria.*]

——— ——— ——— = *Crist. cassis*; see *Nautili* (*Lenticulæ marginatæ*) [No. 6 of d'Orbigny] and *N. læves*, etc.

——— **megalopolitana**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 272, ix, 5. [v. *Cristellaria.*]

——— **metensis**, Terquem. Mem. Ac. Imp. Metz, XXXIX, 1858, 627, iv, 6*a*, *b*.

——— **munsteri**, Roemer. Verstein. norddeutsch. Oolith., Nachtrag, 1839, 48, xx, 29.

——— ——— ——— Roemer, Verst. norddeutsch. Kreide, 1840–41, 98, xv, 30.

——— **nautiloides**, Bornemann. Lias von Göttingen, 1854, 43, iv, 42*a*, *b*.

——— **navis**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 338, xiv, 4 and 5.

——— **neglecta**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 69, iv, 27.

——— ——— ——— Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 284, ii, 8–19.

——— **nitida**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 290, No. 22. This name was given by d'Orbigny to Soldani, Testac. II, App. 1798, 141, pl. 7*zz*, *ZZ*. [Soldani does not appear to have described it; it is probably an *Amphistegina.*]

——— **nitida**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 54, vi, 66*a*, *b*.

——— **nitidissima**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 68, iv, 25.

——— **nodosa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 78, ix, 6*a*, *b*.

——— **notabilis**, Neugeboren. Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 285, iii, 1 and 2.

——— **nuda**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 14, i (vi), 6*a*, *b*.

——— **obtusa**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 369, xlvi, 18.

——— **obtusimargo**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 142, xiii, 22, 22*a*.

——— **ocellus**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 47. [= *Crist. cultrata.*]

——— **oculus**, Stache. Novara-Exped., Geol. Theil I, 1864, 247, xxii [error for xxiii], 27*a*, *b*.

ROBULINA seminuda, Terquem. Cinq. Mém. Foram. Oolithique, 1883, 366, xli, 13*a*, *b*.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 47, v, 3*a*, *b*.
——— **semistriata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xix, 7.
——— **serpens**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 143, xiii, 25 and 25*a*.
——— **signata**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 272, ix, 4.
——— **similis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 98, iv, 14 and 15.
——— **simplex**, d'Orbigny. Foram. Fossiles Vienne, 1846, 103, iv, 27 and 28.
——— ——— ——— Neugeboren, Arch. Ver. siebenburg. Landeskunde, N. F. x, Heft 2, 1872, 286, iii, 3–6.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 70, vii, 21*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Jones, M. Micr. Journ. XV, 1876, cxxviii, 13. [= *Crist. rotulata*, Lam.]
——— **simplicissima**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 141, xiii, 18, 18*a*.
——— **sogamozæ**, Karsten. Amtlicher Ber. 32 Vers. deutscher Nat. Aerzte, 1856, 1858, 114, vi, 5*a*, *b*; and Géol. Colomb. bolivarienne, 1886, 62, vi, 5*a*, *b*.
——— **soldanii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 288, No. 5. [v. *Cristellaria*.]
——— ——— ——— = *Crist.*; see *Nautili globuli.*
——— **spirata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 23, i, 15*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **stellata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 144, xiii, 29.
——— **stellifera**, Czjzek. Haidinger's Nat. Abh. II, 1848, 142, xii, 26 and 27.
——— **striolata**, Czjzek. Haidinger's Nat. Abh. II, 1848, 142, xii, 28 and 29.
——— **subangulata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 53, vi, 64*a*, *b*.
——— **subangulosa**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xiv, 2.
——— **subcultrata**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 26, v, 19 and 20. [*R. cultrata* on plate.]
——— **sublævis**, v. Hagenow. Neues Jahrbuch, 1842, 572.
——— **subnodosa**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 391, iii, 61. [v. *Polystomella*.]
——— **sulcata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 289, No. 10.
——— ——— ——— = *Polystom. striato-punctata*; see *Nautili striati.*
——— **taettowata**, Stache. Novara-Exped., Geol. Theil I, 1864, 252, xxiii, 32*a*, *b*. [*taettovata* in explan. of plate.]
——— **tenuis**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 143, xiii, 26 and 26*a*.
——— **torosa**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 465, iii, 2*a*, *b*.
——— **trachyomphala**, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 34, ii, 12.
——— **trigonostoma**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 69, iv, 26.
——— ——— ———? Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 336, xv, 9 and 10. ("Young forms.")
——— **umbonata**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 68, iv, 24.
——— **vaticana**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 122, i, 17*A*, *B*.
——— **virgata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 290, No. 17.
——— ——— ——— D'Orbigny, Modèles, No. 14, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 14], Ann. Mag. Nat. Hist. [3], XVI, 1865, 20, i, 40.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.

ROSALINA binkhorsti, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 317, ii, *3a–c*.

——— **biseriata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 26, ii (vii), *14a–c*.

——— **bosqueti**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 316, iii, 1*a*, *b*.

——— **bulloides**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 98, iii, 2–5 ; also in Spanish, 1840, 104, same pl. and fig. [v. *Discorbina ; Cymbalopora ; Tretomphalus.*]

——— **calabra**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xiv, 6.

——— **calymene**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 658, ii, 100*a*, *b*, *c*.

——— **canaliculata**, Reuss. Denkschr. k. Ak. Wiss. Wien, VII, Abth. 1, 1854, 70, xxvi, 4.

——— **candeiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 97, iv, 2–4 ; also in Spanish, 1840, 103, same pl. and fig.

——— **catesbyana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 99, iv, 22–24 ; also in Spanish, 1840, 105, same pl. and fig. [*R. calesbyana* on plate.]

——— **clementiana**, d'Orbigny. Mém. Soc. géol. France, [1], IV, 1840, 37, iii, 23–25 ; facsimile in Science Gossip, 1870, 155, fig. 140.

——— ——— ——— Mangin, Mystères Océan, 1864, 177, fig. 9.

——— **complanata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 175, x, 13–15.

——— ——— ——— var. Reuss, Denkschr. k. Ak. Wiss. Wien, I, 1850, 373, xlvii, 5.

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 229, $xxxv^2$, 20*a*, *b*, *c*.

——— **complanata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 86, xi, *3a–c*.

——— **concava**, Reuss. Denkschr. k. Ak. Wiss. Wien, VII, Abth. 1, 1854, 70, xxvi, 3.

——— **conica**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 632, iv, 11*a*, *b*.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 97, x (xviii), *9a–c*.

——— **consobrina**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 46, vii, 4–6.

——— **cora**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 45, vi, 19–21.

——— **crenata**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 243, v, 57.

——— **depressa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 271, No. 6.

——— **discoides** (d'Orbigny). Terquem, Mém. Soc. géol. France, [3], I, 1878, 24, ii (vii), *9a–c*. [*Rotalia*, 1826.]

——— **dubia**, d'Orbigny. Foram. Fossiles Vienne, 1846, 177, x, 19–21.

——— **dubia**, Terq. Mém. Soc. géol. France, [3], II, 1882, 100, xi (xix), 2*a*, *b*.

——— **edwardsiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 101, vi, 8–10 ; also in Spanish, 1840, 106, same pl. and fig.

——— **elliptica**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 15, iii, 2. [? a *Planorbulina.*]

——— **excavata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 98, x (xviii), *11a–c*.

——— **fasciata**, Stache. Novara-Exped., Geol. Theil I, 1864, 281, xxiv, 31*a*, *b*, *c*.

——— **foveolata**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 133, iv, iv, *μ*.

——— **galiciana**, Alth. Haidinger's Naturw. Abh. III, Abth. 2, 1850, 265, xiii, 20. [v. *Planorbulina.*]

ROSALINA marginata, Reuss. Bronn, Ann. Mag. Nat. Hist. [2], xii, 1853, 241, ix, 7.
——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, vii, Abth. 1, 1854, 69, xxvi, 1.
——— ——— ——— Eley, Geol. in the Garden, 1859, 202, ix, 16*C*.
——— ——— ——— Eley, Geol. in the Garden, 1859, 196, iii, 16. [Flint cast.]
——— **mariæ**, Jones. In Prestwich, Quart. Journ. Geol. Soc. viii, 1852, 267, xvi, 13. [= *Planorbulina.*]
——— **mediterranensis**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 271, No. 2. [v. *Pulvinulina.*]
——— ——— ——— = *Pulvin. mediterr.* (d'O.) ; see *Hammoniæ subconicæ.*
——— **megastoma**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 75, ix, 6*a*, *b* [var. 7] ; (and Mém. Soc. Dunkerquoise).
——— **micropora**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— **moniliformis**, Reuss. Geogn. Skizze Böhmen, ii, 1844, pt. 1, 214.
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 36, xii, 30, xiii, 67. [Corrected in Part ii, p. 109, to *Anomalina.*]
——— **nitens**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, Abth. 1, 1862 (1863), 86, xi, 4*a*, *b*.
——— **obtusa**, d'Orbigny. Foram. Fossiles Vienne, 1846, 179, xi, 4–6. [v. *Discorbina.*]
——— ——— ——— Costa, Atti Accad. Pontaniana, vii, fas. 2, 1856, 258, xxii, 14*A*, *B*, *C* [error for xxi, 14, 15, and 16].
——— **ocellata**, Ehrenberg, 1838. [v. *Planulina.*]
——— **opercularis**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 271, No. 7. [v. *Discorbina.*]
——— ——— ——— D'Orbigny, De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 93, iii, 24 and 25, iv, 1 ; also in Spanish, 1840, 101, same pl. and fig.
——— **orbicularis**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. ii, 1850, 407, No. 1328. [*Rosalina*, 1825.]
——— **orbicularis**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 75, ix, 4*a*, *b* ; (and Mém. Soc. Dunkerquoise). [v. *Discorbis*, and *Discorbina.*]
——— **orbiculus**, Stache. Novara-Exped., Geol. Theil i, 1864, 285, xxiv, 34*a*, *b*, *c*.
——— **d'orbignyi**, Soldani. Walther, Mitth. Zool. Stat. Neapel, viii, 1888, 382, xx^{12}.
——— **ornata**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 42, i, 18–20.
——— ——— ——— Hogg, Microscope, 1886, 380, fig. 208^2.
——— **osnabrugensis** (v. Muenster). Reuss, Sitz. k. Ak. Wiss. Wien, xviii, 1856, 243, v, 58. [v. *Planulina.*]
——— **parapsis**, Schwager. Benecke's Geogn. Pal. Beiträge, i, 1866, 310, fig. 16.
——— **parisiensis**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 271, No. 5. [v. also *Discorbis* and *Discorbina.*]
——— ——— ——— D'Orbigny, Modèles, No. 38, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 38], Ann. Mag. Nat. Hist. [3], xvi, 1865, 25, ii, 70.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], ii, 1882, 99, x (xviii), 15–17.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **parkinsoniana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839. "Foraminifères," 99, iv, 25–27 ; also in Spanish, 1840, 105, same pl. and fig. [" *Rotalia beccarii*, d'Orb., 1825."]
——— **patella**, Egger. Neues Jahrbuch, 1857, 278, x, 12–14.
——— **pertusa**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 133, iv, viii, ζ.
——— **peruviana**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 41, i, 12–14.

ROSALINA tenerrima, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— **thiara**, Stache. Novara-Exped., Geol. Theil I, 1864, 279, xxiv, 29*a*, *b*, *c*.
——— ——— ——— var. **elatior**, Stache. Novara-Exped., Geol. Theil I, 1864, 280, xxiv, 30*a*, *b*, *c*.
——— **trifida**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 35, v, 4*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **trocheata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 28 ii (vii), 18*a–c*.
——— **truncata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 35, v, 3*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **valvulata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 271, No. 4.
——— ——— ——— Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 136, ii, 19–21. [v. *Discorbina.*]
——— ——— ——— De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 96, iii, 21 and 32 [error for –23]; also in Spanish, 1840, 103, same pl. and fig.
——— **varians**, Schultze. Organismus Polythal. 1854, 60, iii, 8–13. [= *Discorb. globularis.*]
——— **vesicularis**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 407, No. 1329. [*Rosalia*, 1825.]
——— ——— (Lam.). Parker & Jones, Ann. Mag. Nat. Hist. [2], XIX, 1857, 292, x, 22–24, xi, 13 and 14. [*Discorbites*, 1804.]
——— **viennensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 177, x, 22–24.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 277, viii, 11–13.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 75, ix, 5*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **vilardeboana**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 44, vi, 13–15. [v. *Discorbina.*]
——— **vitrea**, Terquem. Bull. Soc. zool. France, X, 1885, 549, figs. *A*, *B*, *C*.
——— **weinkauffi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, (1), 1863, 68, viii, 97. [v. *Truncatulina.*]
——— Pictet, Traité de Paléont. IV, 1846, 234, xii, 18.
——— Ansted, Ancient World, 1847, 237, fig. 90; ed. 2, 1848, 221, fig. 86.
——— Mantell, Medals Creation, ed. 2, 1854, 361, fig. 119, 1. [Sarcode.]
?——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xvii, 7 and 8.
——— Dawson, Canad. Nat. II, 1857, 422, vii, 17. [= *Polystom. umbilicatula.*]
——— Mantell, Wonders Geol. 1857, 7th ed., 310, fig. 56.
?——— Karrer, Sitz. k. Ak. Wiss. Wien, LII, Abth. 1, 1865 (1866), 497, pl., 13.
——— v. Schlicht, Foram. Septar. Pietzpuhl, 1870, plates xxi and xxii.
——— Terquem, Cinq. Mém. Foram. Oolithique, 1883, 373, xlii, 8 and 9.
——— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 58, vi, 28 and 29, vii, 1*a*, *b*.

ROSTROLINA, v. Schlicht, 1870. Foram. Septar. Pietzpuhl, 1870, plates xxv, xxvi. [= *Polymorphina.*]

ROTALIA, Lamarck, 1804. Ann. Mus. V, 1804, 184; Brady, Report Challenger, 1884, 702.
——— **abstrusa**, Franzenau. Math. termész. értesitö, VII, 1889, 268, v, 6.
——— **abyssorum**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 28.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 15.
——— **akneriana**. See *Ammon. univolutæ.*
——— **ammoniformis**, d'O. P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 174, xii, 149. [*Turbinulina*, 1826.]
——— **(Turbinula)** ——— ——— See *Hammoniæ beccarii*, etc.
——— **ammonis**, Ehrenberg. Mikrogeologie, 1854, XXV, i, *A*, 45. [= *Planorb. ariminensis.*]
——— **ammonoides**, Gümbel. Sitz. k.-bay. Ak. Wiss. 1870, 283. [= *Anomalina.*]
——— **ammonoides**. See *Ammon. concavo-umbilicatæ.*

ROTALIA ammophila, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 652, ii, 90*a*, *b*.
——— **ampla**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 374.
——— **annectens**, Parker & Jones. Phil. Trans. 1865, 387 and 422, xix, 11*a*, *b*, *c*.
——— **antarctica**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 207.
——— **antillarum**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— **antiqua**, Ehrenberg. Mikrogeologie, 1854, xxxvii, xi, *A–D*, 11. [= *Endothyra*, near *bowmani*.]
——— **arenacea**, Carter. Ann. Mag. Nat. Hist. [5], vii, 1881, 363, xviii, 10.
——— **areolata**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 167.
? ——— **argus**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 375.
——— **armata**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 273, No. 22. [v. *Rotalina*.] [v. also *Calcarina*.]
——— ——— ——— D'Orbigny, Modèles, No. 70, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 70], Ann. Mag. Nat. Hist. [3], xvi, 1865, 30, iii, 88.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **articulata**, Dunikowski. Kosmos [Lemberg], iv, 1879, 133, plate, 28.
——— **aspera**, Ehrenberg. Mikrogeologie, 1854, xxvii, 57 and 58; xxviii, 42; xxxi, 44. [= *Globig. cretacea*.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxiii, 28. [= *Planorb. haidingeri?*]
——— **audouini**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 273, No. 19. [v. *Rotalina*.]
——— **auricula**, Ehrenberg. Mikrogeologie, 1854, xxiii, 51. [= *Cristellaria*.]
——— **badensis**, Czj., var. **schreibersii**, Brady. Walther, Mitth. Zool. Stat. Neapel, viii, 1888, 382, xx, 2. [*Rotalina badenensis*, 1848; v. *Pulvinulina*.]
——— **baileyi**, Hall. Trans. Albany Institute, iv, 1858–1864 (Read Nov. 27, 1856), 34. [v. also *Endothyra*.]
——— **barbadensis**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1875 (1876), 158, i, 2.
——— **beccarii**, (Linné). See *Nautilus*, 1758.
[———] [———] ——— D'Orbigny, Ann. Sci. Nat. vii, 1826, 275, No. 40; and Modèles, No. 74*, 1826.
——— ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1838, 133, i, 1. [= *R. beccarii*, var. *ammoniformis* (Linn. and Lam.).]
——— [**becarii**] ——— Brown, Illustr. Recent Conch. Gt. Brit., ed. 2, 1844, 1, i, 11.
——— [**becarii**] ——— var. **perversus**. Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 12.
——— ——— ——— Harvey, Sea-side Book, 1849, 181, figure.
——— ——— ——— Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 3, 27 and 28.
——— ——— ——— G. B. Sowerby, Foram. Colne Tidal River, 1856 [privately printed], plate, figs. 2 and 3.
——— ——— ——— Mackie, Recreative Science, i, 1859, 145, fig. 7. [= *Discorbina globularis*.]
——— ——— ——— Parker & Jones, Phil. Trans. 1865, 388, xvi, 29 and 30.
——— (**Turbinulina**) ——— ——— P., J., & B. [d'O., Modèles, No. 74], Ann. Mag. Nat. Hist. [3], xvi, 1865, 30, iii, 83.
——— ——— ——— v. **orbicularis** (d'O.). Parker & Jones, Phil. Trans. 1865, 389, xvi, 34. [*Discorbis*, 1826.]
——— ——— ——— v. **soldanii** (d'O.). Parker & Jones, Phil. Trans. 1865, 389, xvi, 31–33. [*Rosalina*, 1826.]

* [D'Orbigny was mistaken as to this species: *Streblus beccarii* and *Streblus tortuosus* are both *Nautilus beccarii*, of Linnæus; d'Orbigny gives *Rotalia* (*Turbinulina*) *tortuosa*, Fischer, in Ann. Sci. Nat. vii, 1826, 275, No. 40, as the name of Modèle No. 74.]

ROTALIA beccarii, (Linné), (varieties). Parker & Jones, Phil. Trans. 1865, 387, xvi, 29–34.
——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., ii, 19–21.
——— [———] ——— Harting, Magt van het Kleine, 1866, 101, fig. 40.
——— ——— ——— Brady, Ann. Mag. Nat. Hist. [4], VI, 1870, 303, xii, 8*a–c*.
——— ——— ——— Anon., Science Gossip, 1870, 11, fig. 26.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 173, xii, 147. [v. *R.* (*Turbin.*) *italica*, d'O.]
——— ——— ——— Idem, 172, xii, 148. [v. *Rosalina soldanii*, d'O.]
——— ——— ——— Morris, Lecture Geol. Croydon, [1876], 8, fig. 2^4.
——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 94, fig. 32^2.
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 43.
——— ——— ——— Carpenter, Ency. Brit., 9th ed., IX, 1879, Foraminifera, 380, fig. 18. [Structure.]
——— ——— ——— Nicholson, Manual Palaeont. 1879, I, 116, fig. 18*o*.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 208, iii, 62, iv, 63–66.
——— ——— ——— var. **inflata**, Seguenza. Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 210, iv, 67. [*Rosalina*, 1862.]
——— ——— ——— v. **craticulata**, P. & J. Hamilton, Trans. N. Zealand Inst. XIII, 1881, 395, xvi, 12. [v. *R. craticulata.*]
——— ——— ——— Jones, in Microgr. Dict., ed. 4, 1883, 668, xxiv, 13*a*, *b*, and 14.
——— **[beccari]** ——— Uhlig, Jahrb. k. k. geol. Reichs. XXXIII, 1883, 773, viii, 8.
——— ——— ——— Brady, Report Challenger, 1884, 704, cvii, 2 and 3.
——— ——— ——— Wright, Proc. Belfast Nat. Field Club, 1884–85, App. IX, 1886, 332, xxvii, 15.
——— ——— ——— Gümbel, Geol. Bayern, Th. I, Lief. 2, 1885, fig. 266, 23.
——— **[beccari]** ——— Malagoli, Boll. Soc. geol. Ital. VI, 1887, 523, xiii, 11.
——— **[beccari]** ——— v. **ammoniformis** (d'O.). Malagoli, Boll. Soc. geol. Ital. VI, 1887, 523, xiii, 12.
——— ——— ——— Anon., Sci. News, 4 May, 1888, 413, fig. 17.
——— ——— ——— v. **ammoniformis**, d'O. Malagoli, Atti Soc. Nat. Modena, 3, VII, 1888, 113, iii, 10.
——— ——— ——— Prestwich, Geology, 1888, II, 420, 210*b*, *c*.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 119, ix, 4, 5.
——— ——— ——— See *Hammonis beccarii*, and *Ammon. cochleatæ*, etc.
——— ——— ——— v. **ammoniformis**. Soldani, Testac. I, 1, 1789, 56, pl. 35*T* = this form.
[——— ——— ———?] Targioni, Relaz. d'alc. viaggi, IV, 1770, xiii, etc. pl. 1, figs. 17, 18, 19, 21, 22?, 26–36.
[——— ——— ———] Ledermüller, Mikr. Gemüths, 1763, 16, viii, *a* and *h*.
[——— ——— ———] Seelheim, Nat. Verh. Koninckl. Ak. Wet. XIX, 1879, No. 4, 8. pl. [3 figures]. [Glauc.]
——— **berchtoldsdorfensis**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 387, xvi, *b*, 57.
——— **bimammata**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. X, 1868 (1870), 649, ii, 85*a–c*. [v. *Pulvinulina;* and *Rotalina.*]
——— **bisaculeata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 20. [v. *Calcarina.*]
——— ——— ——— D'Orbigny, Modèles, No. 15, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 15], Ann. Mag. Nat. Hist. [3], XVI, 1865, 21, iii, 89. [= *Calcarina.*]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **borealis**, Ehr. Abhandl. k. preuss. Ak. Wiss. Berlin, 1841, 428.
——— **bosniaskii**, Hantken. Ertek. termesz. köreből, XIII, No. 1, 1883, 31, iii, 1*a*, *b*, *c;* and Math. Nat. Ber. Ungarn, II, 1884, 152.

ROTALIA (**Turbinulina**) **corallinarum**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 275, No. 48.
——— ——— ——— D'Orbigny, Modèles, No. 75, 1826.
——— (**Turbinulina**) ——— ——— P., J., & B. [d'O., Modèles, No. 75], Ann. Mag. Nat. Hist. [3], XVI, 1865, 31, iii, 84. [= *R. beccarii.*]
——— (**Turbinulina**) ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **cordieriana** (d'Orb.). Cooke, Thousand Objects Microsc. 1869, 90, ix, 9. [*Rotalina*, 1840.]
——— **crassula**, Brown. Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 5. [= *Nonionina.*]
——— **craticulata**, Parker & Jones. Phil. Trans. 1865, 387, xix, 12*a*, *b*, *c*.
——— **cretæ**, Ehrenberg. Mikrogeologie, 1854, xxix, 9. [= *Planorb. ammonoides.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 64. [= *Planorb. farcta.*]
——— **cretica**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 28.
——— **cristellarioides**, Reuss. Bull. Ac. Roy. Belg. [2], XV, 1863, 154, iii, 44.
——— **deformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 33.
——— **defrancei** (d'Orb.). Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 104, xiv, 1–7. [*Calcarina*, 1826.] [Structural.]
——— **denaria**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 375.
——— **densa**, Ehrenberg. Mikrogeologie, 1854, xxix, 3*a*, *b*, *c*. [= *Planorb. globulosa* (Ehr.).]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 62. [= *Planorb. farcta.*]
——— **dentata**, Parker & Jones. Phil. Trans. 1865, 387, xix, 13*a*, *b*, *c*.
——— **deplanata**, Reuss. Zeitschr. deutsch. geol. Ges. VII, 1855, 288, xi, 3.
——— **depressa**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 388, iii, 46.
——— **depressa**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 48. [= *Planorb. ariminensis.*]
——— **discifera**, Philippi. Tertiär. nordwest. Deutsch. 1843, 42, i, 26.
——— **discoides**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 5. [v. *Rosalina* and *Rotalina.*]
——— **discus**, Roemer. Neues Jahrbuch, 1838, 388, iii, 52.
——— **dorsalis**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 167.
——— **dubia**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 34.
——— **dufresnii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 12. [v. *Rotalina.*]
——— **egena**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428, ii, vi, 43. [= *Pulv. cultrata ?* d'O.]
——— ——— ——— var. β. Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 6. [v. *Pulvinulina ; P. repanda*, var. ; and *Rotalina.*]
——— ——— ——— Jones & Parker, Quart. Journ. Geol. Soc. XVI, 1860, xx, 46.
——— ——— ——— = *Pulvin. ;* see *Nautili ammoniformes*, etc.
——— **elliptica**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 28.
——— **eocæna**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 650, ii, 87*a*, *b*.
——— **erebi**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 207.
——— **exsculpta**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 222, xi, 4*a*–*c*.
? ——— **fasciata**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 375.
——— **flosculiformis**, Schwager. Novara-Exped., Geol. Theil II, 1866, 262, vii, 109.
——— **fontana**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 184, ii, 16.
——— **formosa**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 9, i, 14.

ROTALIA globulosa-protolepta, Ehr. Ehr., Mikrogeologie, 1854, xxxii, i, 21. [= *Planorb. globulosa.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, ii, 31. [= *Pulvin. canariensis*, d'O.]
——— **globulosa-tenuior**, Ehr. Mikrogeologie, 1854, xxxvii, vi, 3 and 4. [= *Globigerina.*]
——— ——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 60. ["= *R. glob.* 1838."] [= *Planorb. farcta.*]
——— ——— ——— Kübler & Zwingli, Neujahrsblatt Bürgersbibl. Winterthur, 1866, 18, iii, 23. [= *Planorbulina.*]
——— ——— ——— Cooke, Thousand Objects Microsc. 1869, 90, ix, 7.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), i, 22.
——— ——— ——— American Cyclopaedia, VII (1883), 311, fig. 2.
——— **glomerata**, Ehr. Mikrogeologie, 1854, xxxi, 48. [= *Globig. cretacea.*] [v. *Aristerospira.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 63. ["= *R. senaria ?*"] [= *Planorb. farcta.*]
——— **grata**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 163, iv, 17.
——— **gommunis**. [v. *R. communis.*]
——— **grateloupi**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 10.
——— **grœnlandica**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 293.
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 15.
——— **guerinii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 18. [v. *Rotalina.*]
——— **haliotina**, Ehr. Monatsber. k. preuss. Ak. Wiss. Berlin, 1872, 293.
——— **haliotis**, Ehr. Mikrogeologie, 1854, xxv, i, *A*, 27 and 28. [= *Planorb. farcta.*]
——— **hegemanni**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 293.
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 2.
——— **helvetica**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 18, iii, 8. [= *Planorbulina.*]
——— **hemprichii**, Ehr. Mikrogeologie, 1854, xxiv, 62. [= *Planorb. ammonoides.*]
——— **hemisphæriea**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 314, ii, 5*a*–*c*.
——— **heptas**, Ehr. Mikrogeologie, 1854, xxxii, ii, 40. [= ? *Crist. rotulata.*]
——— **ibex**, Ehr. Mikrogeologie, 1854, xxv, ii, *B*, 5. [= *Planorb. ariminensis.*]
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 3.
——— **impressa**, Roemer. Neues Jahrbuch, 1838, 388, iii, 49.
——— **incerta**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 28.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 17.
——— **incrassata**, Ehr. Mikrogeologie, 1854, xxiii, 40. [= *Crist. cultrata.*]
——— **increscens**, Ehr. Mikrogeologie, 1854, xxiii, 30. [= ? *Globigerina.*]
——— **infernalis**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 29.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), xi, 14.
——— **inflata** (Mont.). Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 4. [*Nautilus*, 1808.]
——— **intermedia**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 388, iii, 50.
——— ——— [Roem.]. Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 285, ii, 10.
——— **intermedia**, Harting. Verh. Kon. Ak. Wetensch. X, 1864, 9, i, 5.
——— **(Turbinulina) italica**, d'O. = *R. beccarii* (Linn.); see *Hammoniæ conico-tuberculatæ* and *H. globoso-rotundatæ*.
——— **involuta**, Reuss, var. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 313, ii, 4*a*, *b*.

ROTALIA menardii, d'Orbigny. P., J., & B. [d'O., Modèles, No. 10], Ann. Mag. Nat. Hist. [3], XVI, 1865, 20, iii, 81. [= *Pulvinulina*.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **micheliana** [**micheliniana**] (d'Orb.). Eley, Geol. in the Garden, 1859, 198, v, 27. [*Rotalina*, 1846.] [Flint cast.]
——— **microtis**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 293.
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 5.
——— **millepora**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 167.
———? (**Planulina**?) **monospira**, Ehr. Mikrogeologie, 1854, xxix, 8. [= *Pulvinulina*; see Parker & Jones, Annals, IX, 1872, 184.]
——— **mortoni**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 337, viii, 1*a*–*c*.
——— **naticoides**, Stache. Novara-Exped., Geol. Theil I, 1864, 276, xxiv, 26*a*, *b*, *c*, *d*.
——— **newboldi**, d'Archiac & Haime. Descr. Anim. Foss. groupe nummulitique Inde, [2], 1854, 347, xxxvi, 17*a*–*d*.
——— **nitida**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 31.
——— ——— (**umbilicata**?) ——— Eley, Geol. in the Garden, 1859, 198, v, 24–26. [Flint cast.]
——— **nitidula**, Schwager. Novara-Exped., Geol. Theil II, 1866, 263, vii, 110.
——— **nivea**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134.
——— **nonas**?, Ehr. Mikrogeologie, 1854, xxxii, ii, 36. [= *Crist. rotulata*?]
——— **nonionina**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 81, x, 2*a*, *b*.
——— **northamptonii**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 283, i, 6.
——— **novo-zelandica**, Karrer. Novara-Exped., Geol. Theil I, 1864, 80, xvi, 12.
——— **obscura**, Ehr. Mikrogeologie, 1854, xxx, 27. [Near *Crist. producta*, v. Hagenow.]
——— **obscura**, Sowerby. Dixon, Geol. etc. Sussex, 1850, 85, and 162, ix, 6; and 2d ed. 1878, 172, same pl. and fig. [= *Discorb. trochidiformis*.]
——— **ocellata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134; *Colpopleura*, Bericht, 1844, 67 and 92; and Mikrogeologie, 1854, xxii, 76. [= *Planorb.* near *haidingeri*.]
——— **orbicularis**, d'Orb. Brady, Trans. Linnean Soc. XXIV, 1864, 470, xlviii, 16. [*Gyroidina*, 1826.]
——— ——— ——— Anon., Science Gossip, 1870, 11, fig. 27.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 175, xii, 150.
——— ——— ——— Vine, Science Gossip, 1878, 52, fig. 35.
——— ——— ——— Brady, Report Challenger, 1884, 706, cvii, 5; cxv, 6.
——— ——— ——— See *R. beccarii* (Linn.).
——— **ornata**, Ehr. Abhandl. k. preuss. Ak. Wiss. Berlin, 1838, 134.
——— **ornata**, Carpenter. The Microscope, ed. 6, 1881, 546, fig. 314. [= *Rotalia veneta*, Schultze.]
——— **pachyomphala**, Ehr. Mikrogeologie, 1854, xxvii, 55. [= *Globig. cretacea*.]
——— **pachyphysa**, Ehr. Mikrogeologie, 1854, xxiv, 42. [Near *Trunc. lobatula*.]
——— ——— ——— Hopkins, Execut. Doc. 45 Congress, Sess. 3, IV, Rpt. Chief Engineers, pt. 2, App. W, 1878–79, 885, i, 61.
?——— **palæoceros**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 309, and 337, i, f. ix. [Glauconite.] ["May be *Nonionina*," P. & J.]
——— **palæotetras**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 308 and 337, i, f. viii. [Glauconite.] ["May be *Globigerina*," P. & J.]
——— **palæotrias**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 308 and 339, i, f. vii. [Glauconite.] ["May be *Globigerina*," P. & J.]
——— **pandoræ**?, Ehr. Bericht k. pr. Ak. Wiss. Berlin, 1844, 67; and Mikrogeologie, 1854, xx, ii, 11. [= *Planorbulina*?]

ROTALIA pulchella (d'O.). Brady, Report Challenger, 1884, 710, cxv, 8*a*, *b*. [*Calcarina*, 1839.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **punctata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 13.
——— **punctato-granosa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 147, xiii, 37*a*, *b*.
——— **punctatula**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 25. [v. *Pulvinulina*; and *P. repanda*, var.]
——— ——— ——— D'Orbigny, Modèles, No. 12, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 12], Ann. Mag. Nat. Hist. [3], XVI, 1865, 20, iii, 82. [= *Pulvinulina*.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **pusilla**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 141, vii, 20.
——— **quaterna**, Ehr. Mikrogeologie, 1854, xxvii, 53; xxviii, 34; and xxxi, 39. [= *Globig. cretacea*.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvi, 36. [= *Planorb. farcta*.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxix, 5. [= *Planorb. globulosa* (Ehr.).]
——— ——— ——— β. **floscularis**, Ehr. Mikrogeologie, 1854, xxiv, 43. [= *Planorb. haidingeri*.]
——— ——— ——— ——— ——— Ehr., Mikrogeologie, 1854, xxv, ii, *B*, 9. [Compare "*Planulina flos*."] [= *Planorb. farcta*.]
——— **quaternaria**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 257.
——— **remora**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
——— **repanda**, Parker & Jones. Ann. Mag. Nat. Hist. [3], v, 1860, 175, No. 25. [= *Pulvinulina*.]
——— **reticulata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 83, x, 4*a–c*. [v. *Epistomina*.]
——— **rimosa**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 464, ii, 5*a–c*.
——— **roemeri**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 240, iv, 52.
——— **rosa**, Ehr. Mikrogeologie, 1854, xxvii, 54. [= *Globig. cretacea*.]
——— **rosacea**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 15.
——— ——— ——— D'Orbigny, Modèles, No. 39, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 39], Ann. Mag. Nat. Hist. [3], XVI, 1865, 25, ii, 71. [= *Discorbina*.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **rosea**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 7. [v. *Truncatulina*.]
——— ——— ——— D'Orbigny, Modèles, No. 35, 1826.
——— ——— ——— Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 9, ii, 13.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, iii, 13.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 35], Ann. Mag. Nat. Hist. [3], XVI, 1865, 24, iii, 79. [= *Planorbulina*.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **rudis**, Ehr. Mikrogeologie, 1854, xxiv, 35 and 36. [= *Globigerinæ*.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxvii, iv, 4. [= ? *Globigerina*.]
——— **saxorum**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 2. [v. *Rotalina*.]
——— **scabra**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134; Bericht, 1844, 67; and Mikrogeologie, 1854, xxii, 79. [= *Planorb. farcta*.]
——— **schloenbachi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 84, x, 5*a–c*.
——— **schreibersii** (d'Orb.). See *Nautili cum Ammoniis admixti*, and *Ammon. planorbes*. [*Rotalina*, 1846.]

ROTALIA schroedteri, d'Orb. Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 215, fig. 11. [Probably intended for *schroeteriana*, P. & J.]

——— **schroeteriana**, Parker & Jones, MS. Carpenter, Parker, & Jones, Introd. Foram. 1862, 212, iv, 3 ; xiii, 7–9. [Structural.] [v. *Faujasina*, sp., Williamson, 1853.]

——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 207, ix, 3.

——— [**schroetteriana**] ——— Carpenter, The Microscope, ed. 6, 1881, 575, fig. 330. [Structural.]

——— ——— ——— Brady, Report Challenger, 1884, 707, cxv, 7*a*, *b*, *c*.

——— ——— [Carp. ?]. Malagoli, Atti Soc. Nat. Modena, [3] VII, 1888, 113, iii, 9.

——— **scutellaris**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 709, ii, 13.

——— **semiglobosa**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 85, x, 7*a*, *b* ; xi, 1. [On the plates this variety is called *R. hemisphærica* by mistake ; Reuss, on p. 85, points out the distinguishing features which separate it from that variety.]

——— **semiornata**, Schwager. Benecke's Geogn. Pal. Beiträge, I, 1868, 661, xxxiv, 20.

——— **senaria** ? Ehr. Abhandl. k. Ak. Wiss. Berlin, 1847, 446, i, 98 ; ii, 85.

——— ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1842 ; and Mikrogeologie, 1854, xix, 90. [? *Globigerina.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxiv, 40. [= *Globigerina.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 46 and 47. [= *Globig. cretacea.*]

——— ——— ——— Ehr., Bericht k. pr. Ak. Wiss. Berlin, 1844, 68 ; and Mikrogeologie, 1854, xx, ii, 14*b* ; xxv, ii, *B*, 6. [= *Planorbulina.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xx, i, 55. [= ? *Planorb.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 61. [= *Planorb. farcta.*]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxix, 4. [= *Planorb. globulosa* (Ehr.).]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, ii, 30. [= *Pulvin. canariensis*, d'O.]

——— [**Rotalina** in index] **siblingensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 35, iv, Impressathon, 15. [= a *Planorbulina.*]

——— (**Turbin.**) **siennensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 275, No. 50.

——— (**Turbin.**) ——— ——— = *Planorb. ungeriana* (d'O.) ; see *Hammoniæ univolutæ*.

——— **soldanii**, d'Orb. var. Stache, Novara-Exped., Geol. Theil I, 1864, 273, xxiv, 23*a*, *b*, *c*. [*Gyroidina*, 1826.]

——— ——— ——— var. **prominula**, Stache. Novara-Exped., Geol. Theil I, 1864, 273, xxiv, 24*a*, *b*, *c*.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 176, xii, 151.

——— ——— ——— Toula, Mitth. geogr. Ges. Wien, XVIII, 1875, 165, pl., 18.

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 69, ix, 7 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 80, same pl. and fig.

——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 211, iv, 68.

——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 155, ix, 3.

——— ——— ——— Brady, Report Challenger, 1884, 706, cvii, 6 and 7.

——— ——— ——— See *R. beccarii* (Linn.).

——— **speciosa**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 709, ii, 12.

ROTALIA sphærophora, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
——— **spiculotesta**, Carter. Ann. Mag. Nat. Hist. [4], xx, 1877, 470, xvi, 1–3. [v. also *Carterina.*]
——— **spinulifera**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 93, xiii, 3*a*, *b*, 4*a–c*, 5*a–c*. [v. *Epistomina.*]
——— **squammosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 8. [v. *Rosalina.*]
——— **stellata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134.
——— **stellata**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 242, v, 54.
——— **stigma**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134, iv, xi, *x*.
——— ——— ——— Abhandl. k. Ak. Wiss. Berlin, 1839, 134, ii, ii; Transl., Taylor's Scientific Memoirs, III, 1843, 357, vi, 2. [Not *R. perforata* as stated on plate.] [= *Planorbulina.*]
——— **subcarinata**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 427, No. 1675. [*Gyroidina carinata*, 1826.]
——— **subrotunda**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 14. [v. *Rosalina.*]
——— **subtortuosa**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 388, iii, 45.
——— ——— [Roem.]. Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 284, ii, 9.
——— **suessionensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 23. [v. *Rotalina.*]
——— **sulcata**, Roem. Verst. norddeutsch. Kreide, 1840–41, 97, xv, 20.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 85, xi, 2*a–c*.
——— **sulcigera**, Stache. Novara-Exped., Geol. Theil I, 1864, 275, xxiv, 25*a*, *b*, *c*, *d*.
——— **tenuimargo**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 359, i, 11*a–c*.
——— **terquiemi**, d'Orb., 1849. D'Orbigny, Prodrome de Paléont. I, 1849, 242, No. 270. [v. *Rotalina.*]
——— **thouini**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 273, No. 17.
——— **(Turbinulina) tortuosa**, Fischer. Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— **tracheotetras**, Ehr. Mikrogeologie, 1854, xxviii, 35. [= *Globig. cretacea.*]
——— **trochidiformis**, Lamarck. Bronn, Syst. urweltl. Conchyl. 1824, 7, i, 7*a*, *b*. [*Rotalites*, 1804.]
——— ——— ——— Brown, Elem. Foss. Conch. 1843, 23, ii, 16.
——— **[trochiliformis]** ——— Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 1 and 2.
——— ——— ——— Schwager, Palaeontographica, XXX, 1883, Pal. Theil, 136, xxviii (v), 12*a–d*.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1057, lxxxvi, 48.
——— **trochus**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 272, No. 4.
——— **trochus**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 388, iii, 47. [v. *Pulvinulina elegans*, var.]
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 242, v, 55.
——— **truncana**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 653, ii, 93*a*, *b*, *c*.
——— **tuberculifera**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 313, ii, 2*a–c*.
——— **tuberosa**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 349, i, 4.
——— **(Trochulina) turbo**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 39. [v. also *Rotalina* and *Discorbina.*]
——— ——— ——— D'Orbigny, Modèles, No. 73, 1826.
——— ——— ——— v. **vesicularis**. Parker & Jones, Ann. Mag. Nat. Hist. [3], v, 1860, 293, No. 6. [= *Discorbina vesicularis.*]

ROTALIA turbo, d'Orbigny. Kölliker, Icones Histiologicae, 1864, 31. [Structural.]

——— **(Trochulina)** ——— ——— P., J., & B. [d'O., Modèles, No. 73], Ann. Mag. Nat. Hist. [3], XVI, 1865, 30, ii, 68. [= *Discorbina.*]

——— **(Trochulina)** ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.

——— **turgida**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1839, 135, ii, iv ; Transl., Taylor's Scientific Memoirs, III, 1843, 358, vi, 4. [*Planulina turgida*, Abhandl. 1838.] [= *Crist. rotulata*, Lam.]

——— ——— ——— Williamson, Mem. Lit. Phil. Soc. Manchester, [2], VIII, 1848, 75, pl., 58.

——— **turgida**, v. Hagenow. Neues Jahrbuch, 1842, 570, ix, 22.

——— **tympaniformis**, Schwager. Benecke's Geogn. Pal. Beiträge, I, 1866, 310, fig. 15.

——— **umbilicata ?**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1855, 161, ii, vii. [? *Rotalina ;* ? *Operculina.*] [Glauc.]

——— **umbilicata**, d'Orb., v. **nitida**, Reuss. In Geinitz, Palaeontographica, XX, Th. 2, 1874, 116, xxiii, 12. [*Rotalina*, 1840.]

——— **umbilicatula** (W. & J.). Brown, Illustr. Recent Conch. Gt. Brit., ed. 2, 1844, 1, i, 8. [*Nautilus*, 1798.]

——— **umbilicus**, Ehr. Bericht k. pr. Ak. Wiss. Berlin, 1844, 68 ; and Mikrogeologie, 1854, xx, ii, 13*a*, *b*. [= *Planorbulinæ.*]

——— ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1844, 95 ; and Mikrogeologie, 1854, xix, 88. [= ? *Planorbulina.*]

——— **umbonella**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 221, xi, 5*a–c*.

——— **veneta**, Schultze. Organismus Polythal. 1854, 59, iii, 1–5 ; vii, 22–24, 29. [= *Planorbulina ;* vii, 22–24, 29 = ? *Globigerinæ.*]

——— ——— ——— Harting, Magt van het Kleine, 1866, 102, fig. 42.

——— ——— ——— Claus, Lehrbuch d. Zool. 1885, 153, f. 135.

——— **venusta**, Brady. Report Challenger, 1884, 708, cviii, 2*a*, *b*, *c*.

——— **vermiculata**, Jones & Parker. Quart. Journ. Geol. Soc. XVI, 1860, 305, No. 116. [= *Pulvinulina.*]

——— **weinkauffi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 68, viii, 97*a–c*.

——— **wolgensis**, Ehr. Mikrogeologie, 1854, xxxi, 50 and 51. [= *Globig. cretacea.*]

——— see Schroeter, Neue Litt. u. Beytr. III, 1786, iii, f. 22.

——— Soldani, Testac. I, 1, 1789, 54, pl. 34*K*, *L*, = this genus.

[———] Deshayes, Coq. Foss. Paris, 1824–1837, not descr., cvi, 4–27.

——— Wetherell, Trans. Geol. Soc. Lond. [2], v, 1834 (1840), 135, ix, 13–18. [13 = *C. cultrata ;* 14, 15, 18 = *Planorb. haidingeri*, varr. ; 16, 17 = *Pulv. boueana.*]

——— Wetherell, Mag. Nat. Hist. [2], III, 1839, 162, f. 27. [= *Truncat. lobatula.*]

——— Phillips, Rept. Proc. Geol. Poly. Soc. W. R. Yorkshire, 1844–45 (1846), 279, vii, 7.

——— Mantell, Phil. Trans. 1846, 467, xxi, 2–4, 7–10, 13 and 14. [Showing sarcode body.]

——— Mantell, Phil. Trans. 1846, 466, xxi, 6, 15. [6 = ? ; 15 = *Pulvin.*]

——— Mantell, Phil. Trans. 1846, 468, xxi, 5, and 11. [Sarcode showing ova ?]

——— Pilla, Distinz. terr. Etrurio, 1846, 104, i, 6.

——— Mantell, Wonders Geol. 1848, 6th. ed., 303, fig. 51. [= *Rosalina*, q. v.]

? ——— Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1847, 446, ii, 83.

——— Williamson, Mem. Lit. Phil. Soc. Manchester, [2], VIII, 1848, 75, pl., 56 and 57. [= *Planorb. ammonoides.*]

——— Mantell, Amer. Journ. Sci. v, 1848, 70, etc., figs. 1, 2, and 3. [Soft parts, etc.]

——— Mantell, Wonders Geol. 1848, 6th ed., 250, fig. 42. [= *Truncat. lobatula.*]

? **ROTALIA.** Dixon, Geol. etc. Sussex, 1850, 352, xxvii, 14. [= *Planorb. ammonoides.*]
——— Brocklesby, Views Microscop. World, 1851, 51, figs. 82 and 83.
——— Mantell, Medals Creation, ed. 2, 1854, 351, fig. 114, 1, 2, 3, 6; 356, fig. 116; 358, fig. 117.
——— Mantell, Medals Creation, ed. 2, 1854, 351, fig. 114, 5; 359, fig. 118, 1 and 2; 361, fig. 119, 4. [Sarcode.]
? ——— Ehrenberg, Mikrogeologie, 1854, xxxvi, 68. [= *Planorb. ammonoides.*]
——— sp.? Ehrenberg, Mikrogeologie, 1854, xxxv, *B*, iv, *A*, *n*. [= *Crist.* vel *Nonion.* ?]
——— Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1855, 173, vi, i, *c*; and 176, vii, 13 (?). [vii, 13 (?), is *Planorbulina.*] [Glauc.]
——— Ehrenberg, Abhandl. k. preuss. Ak. Wiss. Berlin, 1855, 164, iii, v. [= *Operculina* vel *Nummulina.*] [Glauc.]
——— Wallich, North Atlantic Sea-bed, pt. 1, 1862, no descr., vi, 21. [Structural.]
——— Chimmo, Bed of Atlantic [1870], 25, ix, 1. [? *Pulvinulina.*]
? ——— Wright, Rept. Proc. Belfast Nat. F. C. App. iii, 1875, 87 [89], iii, 18.
——— Hertwig, Jenaische Zeitschrift für Naturwiss. x, 1876, 41, etc. ii, 5–11.
——— sp. ind. Hopkins, Execut. Doc., 45 Congress, Sess. 3, IV, Rpt. Chief Engineers, pt. 2, App. W, 1878–79, 885, i, 62 and 63.
——— Carpenter, Ency. Brit., 9th ed., IX, 1879, Foraminifera, 374, i, 18; fig. 4; fig. 17.
——— Carpenter, The Microscope, ed. 6, 1881, 573, fig. 328*B*. [Glauconitic cast.]
? ——— cast? v. Dunikowski, Denkschr. k. Ak. Wiss. Wien, XLV, Abth. 2, 1882, 194, vi, 80.
? ——— Keeping, Geol. Mag. dec. II, IX, 1882, 490, xi, 15.
——— Steinmann, Elem. Paléont. I, 1888, 30, fig. 3*B*.
——— Neumayr, Stämme d. Thierreiches, I, 1889 (8), 188, fig. 29.
——— see *Ammonshorn.*
——— see *Nautile.*
——— see *Nautilus.*

ROTALINA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1. [A family group name.]

ROTALINA, d'Orbigny, 1839. In de la Sagra, Hist. Phisique, etc. Cuba, 1839, "Foraminifères;" in Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, vol. II, pt. 2, "Foraminifères;" and in Voyage Amér. Mérid. 1839, vol. v, pt. 5, "Foraminifères."
——— **aculeata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 159, viii, 25–27.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 274, vii, 1–4.
——— **æquabilis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 64, v (xiii), 1*a*, *b*, *c*.
——— **affinis**, Czjzek. Haidinger's Nat. Abh. II, 1848, 144, xii, 36–38.
——— **affinis**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 236, xvii, 6*A*, *B*, *C*.
——— **akneriana**, d'Orbigny. Foram. Fossiles Vienne, 1846, 156, viii, 13–15. [v. *Truncatulina.*]
——— ——— ——— var. Bornemann, Zeitschr. deutsch. geol. Ges. VII, 1855, 340, xvi, 7.
——— **alvarezii**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 35, i, 21; ii, 1 and 2.
——— **ambigua**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 19, i (vi), 17*a*–*c*.
——— **angulifera**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 28, iii, 8*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **anomala**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 30, iii, 12*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **anomphala**, Egger. Neues Jahrbuch, 1857, 275, viii, 8–10.

ROTALINA concamerata (Montagu). Williamson, Recent British Foram. 1858, 52, iv, 101–105. [*Serpula*, 1808 = *Pulvinulina*.]
——— ——— ——— Cooke, Thousand Objects Microsc. 1869, 92, ix, 23.
——— **conoidea**, Czjzek. Haidinger's Nat. Abh. II, 1848, 145, xiii, 4–6.
——— **conoidea**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 122, xv, 1*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **contecta**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 131, ii, 16–18.
——— **contraria**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 76, v, 37. [v. *Bulimina*.]
——— **cordieriana**, d'Orbigny. Mém. Soc. géol. France, [1], IV, 1840, 33, iii, 9–11; facsimile in Science Gossip, 1870, 108, fig. 117. [v. *Rotalia*.]
——— **crassa**, d'Orbigny. Mém. Soc. géol. France, [1], IV, 32, iii, 7 and 8; facsimile in Science Gossip, 1870, 108, fig. 116. [v. *Pulvinulina*, 1840.]
——— **crenularis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 61, iv (xii), 7*a*, *b*, *c*.
——— **cristellaroides**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 57, iii (xi), 15*a*, *b*, *c*.
——— **cryptomphala**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 371, xlvii, 2.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 277, ix, 4–6.
——— **cultrata**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 76, v, 7–9; also in Spanish, 1840, 90, same pl. and fig.
——— ———? ——— Bailey, Smithsonian Contrib. II, 1851, ii, pl., 14–16.
——— **deformis**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 75, iv, 9–11; also in Spanish, 1840, 89, same pl. and fig.
——— **depressa**, Alth. Haidinger's Naturw. Abh. III, Abth. 2, 1850, 266, xiii, 21.
——— **depressa**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 58, iii (xi), 17*a*, *b*, *c*.
——— **difformis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 64, iv (xii), 15*a*, *b*, *c*.
——— **dimidiata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 19, i (vi), 16*a*–*c*.
——— **discifera**, Phil. Jones, Catal. Foss. Foram. B. M. 1882, 29.
——— **discigera**, Egger. Neues Jahrbuch, 1857, 277, viii, 5–7.
——— **discoidalis**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 119, xiv, 1*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— **discoides**, d'Orb. Terq., Mém. Soc. géol. France, [3], II, 1882, 82, viii (xvi), 9*a*–*c*. [v. *Rotalia*.]
——— **dubia**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 78, ii, 29 and 30; iii, 1; also in Spanish, 1840, 91, same pl. and fig.
——— **dufresnii**, d'Orb. Terquem, Mém. Soc. géol. France, [3], II, 1882, 82 viii (xvi), 10*a*–*c*. [*Rotalia*, 1826.]
——— **dutemplei**, d'Orbigny. Foram. Fossiles Vienne, 1846, 157, viii, 19–21. [v. *Truncatulina*; *Planorbulina*; *Pseudotruncatulina*; and *Heterolepa*.]
——— ———? ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xxii, 19.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 274, vii, 8–10.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 26, ii, 7*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **ehrenbergii**, Bailey. Smithsonian Contrib. II, 1851, 10, pl., 11–13.
——— **elegans**, d'Orb. Terq., Mém. Soc. géol. France, [3], I, 1878, 18, i (vi), 12*a*–*c*. [*Rotalia*, 1826.]
——— ———? ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 75, vii (xv), 6*a*–*c*.
——— **elongata**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 24, iii, 28. [= *Pulvinulina*, near *karsteni*.]

ROTALINA involuta, Reuss. Haidinger's Nat. Abh. IV, Abth. 1, 1851, 35, ii, 14.
——— ——— Hitchcock, Elem. Geology, 1860, 30th ed., 141, fig. 98.
——— **involuta**, Terq. Mém. Soc. géol. France, [3], II, 1882, 76, vii (xv), 10*a–c*.
——— **kalembergensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 151, vii, 19–21. [v. *Rotalia.*]
——— ——— ——— Egger, Neues Jahrbuch, 1857, 273, ix, 21–23.
——— **lacrymosa**, Terq. Mém. Soc. géol. France, [3], II, 1882, 71, vi (xiv), 8*a–c*.
——— **lamarckiana**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 131, ii, 13–15.
——— **lenticula**, Reuss. Verstein. böhm. Kreide, 1845–46, I, 35, xii, 17.
——— **liasina**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 59, v (xv), 5*a–c*.
——— **limbata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 80, viii (xvi), 6*a–c*.
——— **lobata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 63, iv (xii), 11*a*, *b*, *c*.
——— **mamilla**, Williamson. Recent British Foram. 1858, 54, iv, 109–111. [= *Discorb. rosacea*, d'Orb.]
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 27, iii, 2*a*, *b*; (and Mém. Soc. Dunkerquoise). [= *Discorb. rosacea.*]
——— **margarita**, Terquem. Six. Mém. Foram. Lias, 1866, 522, xxii, 20–22.
——— **margaritifera**, Terq. Mém. Soc. géol. France, [3], I, 1878, 18, i (vi), 14*a–c*.
——— **marginata**, Cornuel. Mém. Soc. géol. France, [2], III, 1848, 257, ii, 17–19.
——— **marginata**, d'Orb. Terq., Mém. Soc. géol. France, [3], II, 1882, 80, viii (xvi), 5*a–c*. [*Rotalia*, 1826.]
——— **megasphærica** (Gümbel). Terq., Mém. Soc. géol. France, [3], II, 1882, 59, iii (xi), 21*a*, *b*, *c*. [*Discorbina*, 1868.]
——— **menardii**, d'Orb. Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 27, iii, 1*a*, *b*; (and Mém. Soc. Dunkerquoise). [*Rotalia*, 1826.]
——— **meridionalis**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 124, i, 13*A*, *B*, *C*.
——— **micheliniana**, d'Orbigny. Mém. Soc. géol. France, [1], IV, 1840, 31, iii, 1–3; facsimile in Science Gossip, 1870, 107, fig. 114. [v. also *Pulvinulina*; *P. repanda*, var.; and *Rotalia.*]
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, I, 36, xii, 31.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 674, xxiv, 54.
——— **[michelini]** ——— Fritel, Foss. Caract. terr. sed. second. 1888, pl. xx, 33, 34, and 35.
——— **moeschii**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 37, iv, Astartien, 1. [= *Planorbulina.*]
——— **nana**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 371, xlvi, 23.
——— **nautiloidea**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 72, viii, 5*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **[nautiloides]** ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 62, iv (xii), 9*a*, *b*, *c*.
——— **nitida**, Reuss. Geogn. Skizze Böhmen, II, 1844, pt. 1, 214. [v. *Placentula.*]
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, I, 35, viii, 52; xii, 8 and 20.
——— **nitida**, Williamson. Recent British Foram. 1858, 54, iv, 106–108.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 26, ii, 9*a–e*; (and Mém. Soc. Dunkerquoise).
——— **nodosa**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 72, viii, 7*a*, *b*; (and Mém. Soc. Dunkerquoise).

ROTALINA polyrraphes, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 35, iii, 1.
——— **porosa**, Terq. Mém. Soc. géol. France, [3], II, 1882, 84, viii (xvi), 15*a–c*.
——— **problema**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 72, viii, 8*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— **propingua** (Reuss). Egger, Neues Jahrbuch, 1857, 275, vii, 14–17. [*Rotalia*, 1856.]
——— **punctulata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 83, viii (xvi), 12*a–c*.
——— **pustulosa**, Terq. Mém. Soc. géol. France, [3], II, 1882, 77, vii (xv), 12*a–c*.
——— **quadriloba**, Terq. Mém. Soc. géol. France, [3], II, 1882, 77, vii (xv), 11*a–c*.
——— **radiata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 29, iii, 10*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 78, vii (xv), 14*a–c*.
——— **reticulata**, Czjzek. Haidinger's Nat. Abh. II, 1848, 145, xiii, 7–9. [v. *Truncatulina*; *Planorbulina*; *P. farcta*, var.; and *Siphonina*.]
——— **rosea**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 72, iii, 9–11; also in Spanish, 1840, 87, same pl. and fig.
——— **rotata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 83, viii (xvi), 13*a–c*.
——— **sagra**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 77, v, 13–15; also in Spanish, 1840, 91, same pl. and fig.
——— **saxorum**, d'Orb. Terq., Mém. Soc. géol. France, [3], II, 1882, 69, vi (xiv), 4*a*, *b*, *c*. [*Rotalia*, 1826.]
——— **scaphoidea**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 372, xlvii, 3.
——— **schreibersii**, d'Orbigny. Foram. Fossiles Vienne, 1846, 154, viii, 4–6. [v. *Pulvinulina*.]
——— **scutata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 63, iv (xii), 13*a*, *b*, *c*.
——— **semi-marginata** (d'Orb.). Terq., Mém. Soc. géol. France, [3], II, 1882, 56, iii (xi), 12–14. [*Turbinulina*, 1826.]
——— **semiornata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 79, viii (xvi), 2*a–c*.
——— **semiporata**, Egger. Neues Jahrbuch, 1857, 276, viii, 1–3.
——— **semipunctata**, Bailey. Smithsonian Contrib. II, 1851, 11, pl., 17–19.
——— **semipunctata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 83, viii (xvi), 14*a–c*.
——— **septifera**, Terq. Mém. Soc. géol. France, [3], II, 1882, 65, v (xiii), 2*a*, *b*, *c*.
——— **simplex**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 60, v (xv), 6*a*, *b*.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 71, viii, 3*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 76, vii (xv), 9*a–c*.
——— **soldanii**, d'Orbigny. Foram. Fossiles Vienne, 1846, 155, viii, 10–12.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 26, ii, 8*a–d*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Schlumberger, Feuille Jeun. Nat., Jan. 1882, i, 12.
——— **solida**, Terq. Mém. Soc. géol. France, [3], II, 1882, 72, vi (xiv), 12*a–c*.
——— **spectrum**, Terq. Mém. Soc. géol. France, [3], I, 1878, 19, i (vi), 15*a–c*.
——— **spinimargo**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 371, xlvii, 1.
——— **spissa**, Terq. Mém. Soc. géol. France, [3], I, 1878, 18, i (vi), 13*a–c*.
——— **stellata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 27, iii, 3*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 58, iii (xi), 16*a*, *b*, *c*.

ROTALINA voltziana, d'Orbigny. Cooke, Thousand Objects Microsc. 1869, 90, ix, 11.
——— **[voltzii]** ——— Beudant, Géologie, ed. 8, 1858, 117, fig. 101 ; later eds., same fig.
[Rotaline form.] Hooke, Micrographia, 1665, 80, Schem. v, fig. x ; also in 1667, same fig. etc.
[Rotaline form.] Hooke, Micrographia restaurata, 1745, 71, pl. iii, f. 4.
[Rotaline form.] Adams, Micrographia illustrata, 1746, pl. 64, 562 ; ed. 2, 1747, pl. 64, 562 ; ed. 4, 1771, pl. 70, 562. "Resembling the shell of a small water snail [= *R. beccarii*] ; same figure as in Hooke's Micrographia."
[Rotaline forms.] Ginani, Opere postume, 1755, 20, pl. xiv, iii, 112.
——— Lyell, Quart. Journ. Geol. Soc. I, 1845, 64, fig. *a*.
[Rotaline cast.] Bailey, Amer. Journ. Sci. XLVIII, 1845, 343, iv, 30 and 31.
——— Pictet, Traité de Paléont. IV, 1846, 232, xii, 15.
——— Abich, Mém. Ac. Imp. Sci. [Math. Phys.] St. Pétersbourg, [6], VII, 1859, 57, ii, 5*a*, *b*. [*R. beccarii?*]
[Rotaline], Wallich, Quart. Journ. Sci. I, 1864, plate, 5.
——— Williamson, Pop. Sci. Rev. IV, 1865, 176, viii, 2. (After Schultze.) [Showing pseudopodia.]
——— Von Schlicht, Foram. Septar. Pietzpuhl, 1870, plates xx, xxi, xxiii, xxiv, xxxviii.
——— Wallich, Pop. Sci. Rev., N. S. II (xvii), 1878, pl. iv, 3. [Containing sarcoblasts.]
——— de Folin, Congrès Scient. Dax, 1882 (1883), 305, pl., f. 1, 2, and 3. [Sarcode body.]
——— Terquem, Cinq. Mém. Foram. Oolithique, 1883, 368, xli, 16*a*, *b*; xlii, 1–4.
——— Terquem, Mém. Soc. géol. France, [3], IV, 1886, 48–50, v, 8–15.
——— de Folin, Le Naturaliste, Ann. 9, 1887, 140, fig. 18. [Sarcode body.]
ROTALITES, Lamarck, 1804. Ann. Mus. V, 1804, 184.
——— **depressa**, Lamarck. Vélins du Muséum Paris, No. 22, fig. 15.
——— **discorbula**, Lamarck. Ann. Mus. V, 1804, 185, No. 4 ; and VIII, 1806, fig. 9*a*, *b*, pl. 62.
——— ——— ——— Parkinson, Organ. Rem. former World, III, 1811, 160, xi, 3.
——— ——— ——— Lamarck, Coq. Foss. Paris, 1823, 14, xiv, 9*a*, *b*.
——— ——— ——— Lamarck, Ency. Méthod., "Vers," III (1832), 911 (pls. 1827), 466, f. 6 (P. & J. quote "pt. 23," 1816).
——— **orbiculata**, Lamarck. Vélins du Muséum Paris, No. 22, fig. 14.
——— **radiatus**, Montfort. Conch. syst. I, 1808, 163, 41st genre. [= *Numm. perforata*, var. *radiata*.] [v. *Nummulites*.]
——— **sinistrorsa**, Lamarck. Vélins du Muséum Paris, No. 22, fig. 13.
——— **trochidiformis**, Lamarck. Ann. Mus. V, 1804, 184, and VIII, 1806, No. 1, fig. 8*a*, *b*, pl. 62. [v. *Rotalia*; *Rotalina*; and *Discorbina*.]
——— ——— ——— Parkinson, Organ. Rem. former World, III, 1811, 160, xi, 2.
——— ——— ——— Lamarck, Coq. Foss. Paris, 1823, 14, xiv, 8*a*, *b*.
——— (et **ROTULITES**) ——— ——— Defrance, Dict. Sci. Nat. XXXII, 1824, 187 ; XLVI, 1827, 303 ; Atlas, Conch. xiv, 3 ; xix, 1.
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 391, x, 1 [and vi, 3].
——— ——— ——— Lamarck, Ency. Method., "Vers," III (1832), 912 (pls. 1827), 466, f. 8 (P. & J. quote "pt. 23," 1816).
——— ——— ——— Crouch, Introd. Lamarck, 1827, 41, xxii, 5.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, viii, 3.
[ROTULITES] ——— ——— Brown, Conch. Text-book, 1839, 61, x, 16.
——— **[trochiformis]** ——— Brown, Elem. Foss. Conch. 1843 [23], iii, 12.
——— Bowdich, Elem. Conch. Part 1, 1822, 22, ii, 13.

SAGENELLA frondescens, Brady. Report Challenger, 1884, 278, xxviii, 14 and 15.
——— De Folin, Bull. Soc. N. H. Toulouse, XV, 1881, 135 ; 1 new species proposed but not described.
——— See Haeckel's remarks under *Astrorhiza*.
SAGRAINA. See *Sagrina*.
SAGRINA, d'Orbigny, 1839. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 149 ; also in Spanish, 1840, 139 [v. *Uvigerina* *] ; Brady, Report Challenger, 1884, 580.
[**SAGRAINA**] **affinis**, Fornasini. Boll. Soc. geol. Ital. II, 1883, 189, ii, 10*a*, *b*, *c*.
——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VII, 1888, 45, iii, 1, 1*a*, 1*b*.
? ——— **annulata**, Brady. Report Challenger, 1884, 586, lxxvi, 20 and 21.
[**SAGRAINA**] **aspera**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, Jahrg. x, 1878, 157, iii, 26*a*–*d*.
——— **bifrons**, Brady. Quart. Journ. Micros. Sci. XXI, 1881, 64.
——— ——— ——— Brady, Report Challenger, 1884, 582, lxxv, 18–20.
——— **clavata**, Franzenau. Math. termész. értesitö, VII, 1889, 260, v, 3.
——— **columellaris**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 64.
——— ——— ——— Brady, Report Challenger, 1884, 581, lxxv, 15–17.
——— **cretæ**, Ehrenberg. Mikrogeologie, 1854, xxx, 16. [Near *Heterostomella aculeata* (Ehr.).]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxi, 28. [= *Heterostomella aculeata*.]
——— **dimorpha** (Park. & Jones). Brady, Report Challenger, 1884, 582, lxxvi, 1–3. [v. *Uvigerina* (*Sagrina*), 1865.]
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 225, xlv, 6.
——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 166, fig. 508.
——— **divaricata**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 276, viii, 22–24. [v. *Nubecularia*.]
——— **limbata**, Brady. Report Challenger, 1884, 586, cxiii, 14.
——— ——— ——— Howchin, Trans. Roy. Soc. S. Austral. XII, 1889, 11, i, 7.
——— **longirostris**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 22. [= "*Loxost. tumens*," = *Heterostomella aculeata*, smooth var.]
——— **nodosa**, Park. & Jones. Brady, Report Challenger, 1884, 583, cxiv, 18*a*, *b*. [*Uvigerina* (*Sagrina*), 1865.]
——— **pulchella**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 150, i, 23 and 24 ; also in Spanish, 1840, 140, same pl. and fig.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 252, xxi, 48 and 49.
[**SAGRAINA**] ——— ——— Reuss' Models, No. 83, 1865 (Catal., No. 77, 1861).
——— **raphanus**, Park. & Jones. Brady, Report Challenger, 1884, 585, lxxv, 21–24. [*Uvigerina* (*Sagrina*), 1865.]
——— **rugosa**, d'Orbigny. Mém. Soc. géol. France, [1], IV, 1840, 47, iv, 31 and 32 ; Facsimile in Science Gossip, 1870, 157, fig. 156.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 678, xxiv, 70.
[**SAGRAINA**] ——— ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 92, xxix[1], 24.
——— ——— ——— Beudant, Géologie, ed. 8, 1858, 117, fig. 96 ; later eds., same fig.
[**SAGRAINA**] **striata** (Schwager). Boll. R. Com. geol. Ital. VIII, 1877, 25, pl., 35. [*Dimorphina*, 1866.]
——— ——— ——— Brady, Report Challenger, 1884, 584, lxxv, 25 and 26.
? ——— **tessellata**, Brady. Report Challenger, 1884, 585, lxxvi, 17–19.
——— **virgula**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 275, viii, 19–21.

* Phil. Trans. 1865, 364.

SCHWAGERINA verbeeki (Geinitz). Roemer, Palaeontographica, XXVII, 1880 (1881), 4, i, 1*a*, *b*. [v. *Fusulina.*]

——— ——— ——— Roemer, Lethaea Geognostica, Th. I, Lief. 1, 1880, 278, fig. 46.

——— ——— ——— Schwager, Richthofen's China, IV, 1883, 135, xvi, 14, 17, and 18 ; xvii, 9–17.

——— **[verbecki]** ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1053, lxxxvi, 26.

SCORTIMUS navicularis, Montfort. Conch. syst. I, 1808, 251, 63d genre. [= *Cristellaria*, q. v.]

"Seesterne." Knorr & Walch, Rec. Monumens catastrophes, 1768–1778, III, 181, pl. 6*, f. 9–16. [= *Siderolina calcitrapoides.*]

SEGUENZA. Silvestri, Boll. Soc. Italiana Microsc. I (1 and 2), 1889, 57.

——— **anomala**, Silv. Idem, 58, iii, 3–5.

SELENOIDES, D. D. Owen, 1852. Report Geol. Surv. Wisconsin, 1852, 586. [= *Receptaculites.*]

——— **iowensis**, D. D. Owen. Idem, 587, ii, *B*, 13.

SELENOSTOMUM, Ehrenberg, 1858. Monatsber. k. pr. Ak. Wiss. Berlin, 1858, 12. [E familia Rotalinarum, sectione Nautiloidum ; spira in utroque latere obtecta, oris apertura in sinistro singularum cellularum medio latere rimam curvatam reflexam supra marginem ascendentem referente.]

——— **ægæum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 29.

——— **fimbriatum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 29.

Semina. Spada, Corporum lapid. Agri Veronensis, 1739, 49, no figs. [= *Nummulites ?*]

Semina anisi fœniculi. }
——— **cuminicum.** } Langius, Hist. lap. fig. Helvet. 1708, 69, pl. xviii.
——— **melonum.** }

——— **cumini-pratensis.** Kircher, Mund. subterr. 1665–78, 29. [= *Nummulites.*]

SEPTAMMINA, Meunier. Bull. Soc. Hist. Nat. Autun, I, 1886, 235.

——— **dichotoma**, Meunier. Idem, 236, vii, 5.

——— **renaulti**, Meunier. Idem, 235, vii, 3.

SERPULA, auct.

——— **angulosa**, v. Martens. Reise nach Venedig, Th. II, 1824, 482, iii, 8. [= *Miliolina.*]

——— **bicornis**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microsc. 1798, 633, xiv, 2. [Walker's i, 2 = *Miliolina seminulum*, Linn., young.] [v. *Adelosina ; Miliola ; Miliolina ; Triloculina ; Quinqueloculina.*]

——— ——— **umbilico perforato**, Walker & Boys. Test. Min. [1784], 2, i, 3. [= *Miliolina seminulum*, Linn.]

——— ——— **ventricosa**, Walker & Boys. Test. Min. [1784], 1, i, 2. [= *Miliolina seminulum*, Linn., young specimen.]

——— **concamerata**, Montagu. Test. Brit. Suppl. 1808, 160 (fide Williamson). [v. *Rotalina ; Pulvinulina ; P. repanda*, var. ; and *Discorbina.*]

——— **filum**, Schmid. Neues Jahrbuch, 1867, 583, vi, 48. [v. *Ammodiscus ; Trochammina.*]

——— **lactea**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microsc. 1798, 634, xiv, 4. [Walker's i, 5 = *Polymorphina lactea*, W. & J.] [v. *Miliola ;* and *Polymorphina.*]

——— **(Lagena) lævis globosa**, Walker & Boys. Test. Min. [1784], 3, i, 8. [= *Lagena globosa*, Mont.]

——— **(Lagena) lævis ovalis**, Walker & Boys. Test. Min. [1784], 3, i, 9. [= *Lagena sulcata*, var. *lævis*, Mont.]

——— **(Lagena) sulcata**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microsc. 1798, 634, xiv, 5. [Walker's i, 6 = *Lagena sulcata.*]

——— **lenticularis**, v. Martens. Reise nach Venedig, Th. II, 1824, 482, iii, 9. [= *Adelosina.*]

SERPULA **lobatula**, Montagu. Test. Brit. 1803, 515 ; Suppl. 1808, 160. [= *Truncatulina ; see Nautilus.*]

——— (Lagena) **marginata**, Walker & Boys. Test. Min. [1784], 2, i, 7. [= *Lagena marginata*, Mont.] [v. *Vermiculum ; Lagena ; Entosolenia ;* and *Lagena sulcata.*]

——— **ovalis**, Walker. Adams, Trans. Linnean Soc. III, 1800, 4, i, 28, 29, 30. [*Miliolina.*]

——— **perforata**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microsc. 1798, 633, xiv, 3. [Walker's i, 3 = *Miliolina seminulum*, Linn., young.] [v. *Miliola ;* and *Triloculina.*]

——— (Lagena) **perlucida** [Montagu]. Turton, Conch. Dict. 1819, 157, vii, 23. [*Vermiculum*, 1803.]

——— **pusilla**, Geinitz. Verstein. deutsch. Zechsteingebirges u. Rothliegenden, Heft I, 1848, 6, iii, 3, 4, 5, 6. [v. also *Trochammina ; Spirillina.*]

? ——— ——— ——— Jones, in King, Pal. Soc. 1850, 57, vi, 7–9 ; xviii, 13*a–d*.

——— ——— ——— Geinitz, Dyas, etc. 1861, Heft I, 39, x, 15–21.

——— **retorta**, Walker & Jacob. In Kannmacher's ed. of Adams' Essays Microsc. 1798, 634, xiv, 6. [Walker's i, 10 = *Miliolina seminulum*, Linn., young.] [v. *Lagena.*]

——— (Retorta) **rotunda marginata cervice curvatim exerto**, Walker & Boys. Test. Min. [1784], 3, i, 10. [= *Miliolina seminulum*, Linn., young.]

——— **roessleri**, Schmid. Neues Jahrbuch, 1867, 583, vi, 46 and 47.

——— **seminulum**, Linné. Syst. Nat. 1758, ed. x, 786 ; Gmelin's (xiii), ed. 1788, 37, 39. [v. *Quinqueloculina ; Miliola ;* and *Miliolina.*]

——— ——— ——— Modeer, Nova Acta Acad. Caes. Leop. Carol. VIII, Appendix, 1791, 93, figure.

——— ——— ——— Pulteney, Catalogue in Hutchins, Hist. of Dorset, 2d ed. III, 1813, 60, xix, 31.

——— ——— ——— Brady, Report Challenger, 1884, 158, fig. 2. [Copied from Plancus, Gaulteri, and Martini.]

——— (Lagena) **striata sulcata rotunda**, Walker & Boys. Test. Min. [1784], 2, i, 6. [= *Lagena sulcata*, W. & J.] [v. *Vermiculum ; Lagena ;* and *Lagenulina.*]

——— **subovalis intorta umbilico pervio**, Walker & Boys. Test. Min. [1784], 1, i, 1. [= *Miliolina seminulum*, Linn.]

——— **subrotunda dorso elevato**, Walker & Boys. Test. Min. [1784], 2, i, 4. [= *Miliolina seminulum*, var. *subrotunda*, Mont.]

——— **tenuis ovalis lævis**, Walker & Boys. Test. Min. [1784], 2, i, 5. [= *Polymorphina lactea*, W. & J.]

——— **urnæ** [Montagu]. Turton, Conch. Dict. 1819, 158, vii, 21. [*Vermiculum*, 1803.]

SEXLOCULINA, Czjzek, 1848. Haidinger's Nat. Abh. II, 1848, 149. [= *Sphæroidina.*]

——— **haueri**, Czjzek. Haidinger's Nat. Abh. II, 1848, 149, xiii, 35–38.

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 249, xxxv^{3}, 8*a*, *b*, *c*.

Sextularia, Leidy, 1884. Misprint for *Textularia.*

Shæroidina, Schwager, 1866. Misprint for *Sphæroidina.*

SHEPHEARDELLA, Siddall, 1880. Q. Journ. Micros. Sci. XX, 1880, 131. [One of the *Gromidæ.*]

——— **tæniformis**, Siddall. Quart. Journ. Micros. Sci. XX, 1880, 131, pl. XV.

SIDEROLINA, Defrance, 1824. Dict. Sci. Nat. XXXII, 1824, 180.

——— **calcitrapoides** (Lamarck). [*Siderolites*, 1801.]

——— [**calcytrapoides**] (Lam.). Defrance, Dict. Sci. Nat. XXXII, 1824, 180 ; XLIX, 1827, 98 ; Atlas, Conch. xiii, 7. [= *Calcar. spengleri*, Gümb.]

——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 297, No. 1.

——— ——— [d'Orb.]. Guérin-Menéville's Cuvier, Iconographie, Mollusques, 1829–43, 9, ii, 8.

SIDEROLINA calcitrapoides [d'Orb.]. Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 17, iii, 8.
——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. X), 33, xv, 6.
——— ——— ——— Pilla, Distinz. terr. Etrurio, 1846, 104, i, 13.
——— ——— ——— Knorr, "Petrifacta," 1755–1773, III, supp., figs. 9–16.
——— **cruscula**, Harting. Verh. Kl. Koninkl.-Nederland. Inst. [3], IV, 1852, 115, ii, 7*a*, *b*, *c*. [= ?]
——— **defrancii**, Deshayes. Ency. Méth. "Vers," 1832, 948.
? ——— **indica**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 376.
——— **kochi**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 68, xvi, 1; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 79, same pl. and fig.
——— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 297, No. 2. [v. *Calcarina.*]
——— ——— ——— D'Orbigny, Modèles, No. 89, 1826.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 89], Ann. Mag. Nat. Hist. [3], XVI, 1865, 33, iii, 90. [= *Calcarina.*]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.
? ——— **liasina**, Terquem. Mém. Ac. Imp. Metz, XXXIX, 1858, 618, iii, 13*a*, *b*.
——— Pictet, Traité de Paléont. IV, 1846, 228, xii, 8 and 9.
——— Ansted, Ancient World, 1847, 237, fig. 91; ed. 2, 1848, 221, fig. 87.
———? see *Lenticulæ.*

"Siderolina-ähnliche formen." Gümbel, Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 235, iv, 19. [= Sponge spicule.]

SIDEROLITES, Lamarck, 1801. Syst. Anim. s. Vert. 1801, 376.
——— **calcitrapoides**, Lamarck. Syst. Anim. s. Vert. 1801, 376. [v. *Siderolina*; and *Calcarina.*]
——— **[calcitrapoide]**, Lamarck. Faujas de St. Fond,* Hist. Nat. Mont St. Pierre Maestricht, 1799, 188, xxxiv, 5–12.
——— **[calcitrapes]** ——— Montfort, Conch. Syst. I, 1808, 151, 38th genre.
——— ——— ——— Lamarck, Ency. Method. "Vers," III (1832), 948 (pls. 1827), 470, f. 4 (P. & J. quote "pt. 23," 1816).
——— ——— ——— Bowdich, Elem. Conch. Part I, 1822, 15, i, 23.
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 373, v, 7.
——— ——— ——— Crouch, Introd. Lamarck, 1827, 41, xxii, 8.
——— ——— ——— Brown, Conch. Text-book, 1839, 60, x, 12.
——— ——— ——— Brown, Elem. Foss. Conch. 1843, 23, ii, 10.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1053, lxxxvi, 24.
——— **hexagonus**, Eichwald. Zoologia specialis, II, 1830, 25, ii, 5. [? a *Polystomella.*]

SIDEROLITHES calcitrapoides, Lam. Bronn, Syst. urweltl. Conchyl. 1824, 7, i, 21.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein, 1845–46, 661, xxiv, 46.
——— ——— ——— Reuss' Models, Nos. 53 and 54, 1865 (Catal., Nos. 88 and 89, 1861).

SIDEROLITHUS calcitrapoides, Bronn. Lethaea Geognostica, ed. 2, 1837, 712, xxiii, 17*a*, *b*, *c*.
——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 83, xxxiii, 17*a*–*c*.

SIDEROPORUS calcitrapa (Lam.). Bronn, Syst. urweltl. Pflanzenthiere, 1825, 31, vii, 12*a*–*g*. [v. *Siderolithus.*]

SIGMOÏLINA, Schlumberger, 1887. Bull. Soc. zool. France, XII, 1887, 118. [This name was proposed for the forms, *Planispirina sigmoïdea*; *P. celata*; *Miliolina secans*; *Spiroloculina tenuis.*]
——— **secans** (d'Orb.). Halkyard, Trans. Manchester Microsc. Soc. 1889, 61, i, 7 (var. *obliquistriata*).

* St. Fond probably showed his specimens to Lamarck, and so the name appeared in 1799.

SOLDANIA nitida, d'O. Ann. Sci. Nat. VII, 1826, 281, No. 3. This name was given by d'Orbigny to Soldani, Testac. I, pt. 2, 1791, 151, pl. 135*J*. [Soldani describes it as "alterum [*J*] est *Hammonia*, sive potius *Nautilus dimidiatus*;" it is a fragment of a section of a *Planorbulina*?]
——— **orbicularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 281, No. 5.
——— ——— ——— = *Cornuspira*?; see *Hammonia*.
——— **spirorbis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 281, No. 2.
——— ——— ——— = *Numm. exponens* (Sow.); see *Porpitæ soluti*.
?——— Pilla, Distinz. terr. Etrurio, 1846, 104, i, 8.
SOLDANINA, Costa, 1856. Atti Accad. Pontaniana, VII, fas. 2, 1856, pl. 246.
——— **exagona**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 248, xxi [error for xx], 6*A*, *B*
SORITES dominicensis, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134.
?——— **edentulus**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— **orbiculus**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134; and v. *triptera*. [= Young stage of *Orbitolites orbiculus* (Forsk.).]
SORITINA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1. [A family group name.]
SOROSPHÆRA, Brady, 1879. Q. Journ. Micr. Sci. XIX, 1879, 28; Brady, Report Challenger, 1884, 251.
——— **confusa**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 28, iv, 18 and 19.
——— ——— ——— Moseley, Nature (Apr. 15, 1880), XXI, 570, fig. 11*b*.
——— ——— ——— Brady, Report Challenger, 1884, 251, xviii, 9 and 10.
——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 162, fig. 490.
Sphacroidea, Giebel, 1852. Misprint for *Sphæroidina*?
SPHÆROIDINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 267; Brady, Report Challenger, 1884, 619.
——— **austriaca**, d'Orbigny. Foram. Fossiles Vienne, 1846, 284, xx, 19–21.
——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, I, 1850, 387, li, 3–19.
——— ——— ——— Egger, Neues Jahrbuch, 1857, 273, vi, 19 and 20.
——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 185, xii, 13.
——— ——— ——— Reuss' Models, No. 37, 1865 (Catal., No. 71, 1861). [= *S. bulloides*, d'O.]
——— ——— ——— Schwager, Novara-Exped., Geol. Theil II, 1866, 250, vii, 98.
——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 53, x, 4; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 62, same pl. and fig.
——— ——— ——— Zittel, Handbuch Palaeont., Abth. I, 1876, 88, fig. 25[1].
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 25, pl., 41.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 211, ix, 15.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 188, i, 20.
——— ——— ——— Jones, in Micrrogr. Dict. ed. 4, 1883, 704, xxiv, 4.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1061, lxxxvii, 13.
——— **bulloides**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 267, No. 1.
——— ——— ——— D'Orbigny, Modèles, No. 65, 1826.
——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. x), 34, xv, 9.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 318, xxiv, *A*, *B*, *C* [error for xxv, 1]. [Quoted as *Sexloculina* of Czjzek.]
——— ——— ——— P., J., & B. [d'O., Modèles, No. 65], Ann. Mag. Nat. Hist. [3], XVI, 1865, 29, ii, 58.
——— ——— ——— Parker & Jones, Phil. Trans. 1865, 369, xvi, 52.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 38, vi, 1; (and Mém. Soc. Dunkerquoise).

SPIRILLINA gracilis, Terquem. Mém. Soc. géol. France, [3], IV, 1886, 8, i, 12*a*, *b*.
——— **helvetica**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 12, ii, 8.
——— ——— ——— Jones, Quart. Journ. Geol. Soc. XL, 1884, 770, xxxiv, 12.
——— ——— ——— Prestwich, Geology, 1888, II, 195, 96*a*.
——— **impressa** (Egger). Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 53. [? *Cyclolina*, 1857.]
——— ——— ——— Gümbel, Geol. Bayern, Th. I, Lief. 2, 1885, fig. 266, 13.
——— **inæqualis**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 278, viii, 25*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 631, lxxxv, 8–11.
——— **irregularis**, v. Moeller. Mém. Ac. Imp. Sci. St. Pétersbourg, [7], XXVII, No. 5, 1879, 29 [fig. 8].
——— **latiseptata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 1, 1875, 21, i, 6 ; (and Mém. Soc. Dunkerquoise).
——— **limbata**, Brady. Quart. Journ. Micr. Sci. XIX, 1879, 278, viii, 26*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 632, lxxxv, 18–21.
——— ——— v. **denticulata**, Brady. Report Challenger, 1884, 632, lxxxv, 17.
——— **mamillata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 33, i (ix), 31*a*, *b*.
——— **margaritifera**, Williamson. Recent British Foram. 1858, 93, vii, 204.
——— **margaritifera**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 110, xiii, 2*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Wright, Proc. Belfast Nat. Field Club, 1884–85, App. IX, 1886, 321, xxvi, 12*a*, *b*.
——— **nodifera**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 34, i (ix), 32*a*, *b*.
——— **nodosa**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 110, xiii, 1*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— **numismalis**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 17, i (xi), 13. [v. *Cornuspira.*]
——— **obconica**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 279, viii, 27*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 630, lxxxv, 6 and 7.
——— **orbicula**, Terq. et Berth. Mém. Soc. géol. France, [2], X, 1875, 17, i (xi), 12*a–c*. [v. *Cornuspira.*]
——— **perforata** (Schultze). Williamson, Recent British Foram. 1858, 92, vii, 202. [*Cornuspira*, 1854 ; = *S. vivipara*, Ehr.]
——— ——— ——— Williamson, Pop. Sci. Rev. IV, 1865, 174, viii, 9.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 1, 1875, 21, i, 5 ; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Jones, in Microgr. Dict., ed. 4, 1883, 714, xxiv, 5.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 33, i (ix), 29.
——— **plana**, v. Moeller. Mém. Ac. Imp. Sci. St. Pétersbourg, [7], XXVII, No. 5, 1879, 28 [figs. 6 and 7].
——— **polygyrata**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 214, vi [error for iv], 11*a*, *b*, *c*.
——— **punctata**, d'Orb. Reuss' Models, No. 73, 1865 (Catal., No. 31, 1861).
——— **pusilla** (Geinitz). King, Journ. Geol. Soc. Dublin, VII, pt. 2, 1856, 73, i, 12*a*, *b*. [*Serpula*, 1848 ; = *Trochammina.*]
——— **radiata**, Terquem. Mém. Soc. géol. France, [3], IV, 1886, 8, i, 13 and 14.
——— **regularis**, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 481, xv, 2.
——— **striato-granulosa**, Terq. Mém. Soc. géol. France, [3], II, 1882, 33, i (ix), 30.
——— **subangulata**, v. Moeller. Mém. Ac. Imp. Sci. St. Pétersbourg, [7], XXVII, No. 5, 1879, 27 [fig. 5], v, 3.
——— **tenuissima**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 214, iv, 12*a*, *b*. [v. *Cornuspira.*]

SPIROLINA bathonica, Deecke. Mém. Soc. Emul. Montbéliard, XVI, 1886, [46], i, 7*a*.
——— **carinatula** (W. & J.). Brown, Illustr. Recent Conch. Gt. Brit., ed. 2, 1844, 1, i, 7. [*Nautilus*, 1798.]
——— **clavata**, Crouch. Introd. Lamarck, 1827, 40, xx, 8.
——— ——— ——— Brown, Conch. Text-book, 1839, 63, x, 23.
——— **cylindracea**, Lamarck. Parkinson, Organ. Rem. former World, III, 1811, 162, xi, 9, and 10 var. ? [*Spirolinites*, 1804.]
——— ——— ——— Lamarck, Ency. Method., "Vers," III (1832), 972 (pls. 1827), 466, f. 2 (P. & J. quote "pt. 23," 1816).
——— ——— ——— Lamarck, Ency. Method., "Vers," III (1832), 972 (pls. 1827), 465, f. 7 (P. & J. quote "pt. 23," 1816). [= *Peneroplis*.]
——— ——— ——— var. Lamarck, Ency. Method., "Vers," III (1832), 972 (pls. 1827), 466, f. 3 (P. & J. quote "pt. 23," 1816). [= *Peneroplis*.]
——— ——— ——— Bronn, Syst. urweltl. Conchylien, 1824, 9, i, 15*a–c*.
——— ——— ——— Blainville, Malacologie, 1825, v, 1. [= *Peneroplis*.]
——— ——— ——— König, Icones fossilium sectiles, [1825], n. d., x, 125.
——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 286, No. 1.
——— ——— ——— D'Orbigny, Modèles, No. 24, 1826.
——— (et **Spirolinites**) ——— ——— Defrance, Dict. Sci. Nat. L, 1827, 298 ; Atlas, Conch. xiii, 1. [= *Peneroplis*.]
——— [**cylindrica**] ——— Bronn, Lethaea Geognostica, ed. 2, 1837, 1135, xlii, 24*a*, *b*.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 659, xxiv, 37.
——— ——— ——— Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 9.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 24], Ann. Mag. Nat. Hist. [3], XVI, 1865, 22, i, 19.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 52, iii (xi), 4*a*, *b*, 5.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.
——— **depressa**, Lamarck. Parkinson, Organ. Rem. former World, III, 1811, 162, xi, 8. [*Spirolinites*, 1804.]
——— ——— ——— Blainville, Malacologie, 1825, v, 2. [= *Peneroplis*.]
——— (et **Spirolinites**) ——— ——— Defrance, Dict. Sci. Nat. L, 1827, 298 ; Atlas, Conch. xiii, 2. [= *Peneroplis*.]
——— ——— ——— Mantell, Pictorial Atlas Foss. Rem. 1850, 143, lxii, 8.
——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 53, iii (xi), 10*a*, *b*.
——— **grandis**, Reuss. Denkschr. k. Ak. Wiss. Wien, VII, Abth. 1, 1854, 69, xxv, 14.
——— (**Dendritina**) (cf.) **haueri**, d'O. Schwager, Palaeontographica, XXX, 1883, Pal. Theil, 91, xxiv (i), 11*a–c*. [*Dendritina*, 1846.]
——— **hemprichii** (Ehr.). P., J., & B., Ann. Mag. Nat. Hist. [3], XV, 1865, 230. [v. *Coscinospira*.]
——— ——— ——— See *Nautilus* (*Lituus*) *arietinus*, Batsch.
——— **humboldti**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 65, iii, 17 and 18. [v. *Haplophragmium*.]
——— **inæqualis**, Roem. Reuss, Verstein. böhm. Kreide, 1845–46, i, 35 ; viii, 62–66, and 75 ; in Part ii, 109, corrected to *Spirolina irregularis*. [v. *S. irregularis*.]
——— **inflata**, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 32, ii, 5 and 6.
——— **irregularis**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 98, xv, 29. [v. *S. inæqualis ; Spirulina ; Lituolina ; Haplophragmium*.]
——— **juleana** (d'Orb.). Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 27, pl., 109. [*Dendritina*, 1846.]
——— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 287, No. 4.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 52, iii (xi), 6*a*, *b*.

SPIROLINA lagenalis, Roemer. Verst. norddeutsch. Kreide, 1840–41, 98, xv, 28.

——— **legumen** (Montagu). Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 22 and 23 [error for 21 and 23]. [*Nautilus*, 1808.]

——— **lituus**, Parker, Jones, & Brady. Ann. Mag. Nat. Hist. [3], XVI, 1865, 35, i, 19. [= *Peneropl. cylindraceus.*]

——— **longissima**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 225, xix [error for xx], ii, *A*, *B*, *C*.

——— **nautiloides** (Lamarck). D'Orbigny, Ann. Sci. Nat. VII, 1826, 287, No. 6. [*Lituolites*, 1822.]

——— **pedum**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 287, No. 5.

——— ——— ——— Terquem, Mém. Soc. géol. France, [3], II, 1882, 53, iii (xi), 9*a*, *b*.

——— **pusilla**, Schwager. Palaeontographica, XXX, 1883, Pal. Theil, 92, xxiv (i), 12*a–c* ; xxix (vi), 9*a–c*.

——— **sacheri**, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 31, ii, 3 and 4.

——— **semilitua** (Montagu). Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 22. [*Nautilus*, 1808.]

——— [**similitua**] ——— Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 22. [*Semiletua*, in errata, v. *Nautilus.*]

——— **simplex**, Reuss. Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 232, ii, 30.

——— **stenostoma**, Deshayes. In Lyell, Principles of Geology, III, 1833, 251, iv, 15–18.

——— ——— ——— Brown, Elem. Foss. Conch. 1843, 25, ii, 33 and 35.

[**SPIRALINA**] **streitbergensis**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 232, iv, 7*a*, *b*.

——— **striata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 287, No. 2.

——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 53, iii (xi), 7 and 8.

[——— **subarcuatula**] [Mont.]. Brown, Illustr. Conch. Gt. Brit. 1827, fly-leaf, lii, 27. [Name omitted in 1st ed. ; given in 2d, v. *Nautilus*, 1808.]

——— ——— ——— Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 1, i, 27.

——— Deshayes, Coq. Foss. Paris, 1824–1837, not descr., pl. cv, 19, 25, and 26.

——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 191, iv, 22 and 23.

——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), not descr., v, 2. [= *Peneroplis.*]

——— see *Peneroplis*.

SPIROLINITES, Lamarck, 1804. Ann. Mus. V, 1804, 245.

——— **complanata**, Lamarck. Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, viii, 8. [This fig. is the *Spirolina depressa*, Lam. fig'd by Defrance, q. v.]

——— **cylindracea**, Lam. Ann. Mus. V, 1804, 245, No. 2 ; and fig. 15, pl. 62, in vol. VIII, 1806. [v. *Spirula ; Spirulina ; Spirolina ; Peneroplis.*]

——— ——— ——— var. Lamarck, Ann. Mus. V, 1804, 245, No. 2 ; and fig. 16*a*, *b*, pl. 62, in vol. VIII, 1806. [= *Clavulina ?*]

——— ——— ——— and var. Lamarck, Coq. Foss. 1823, 14, xiv, 15 and 16*a*, *b*.

——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls., 1837), 18, viii, 7.

——— **depressa**, Lamarck. Ann. Mus. V, 1804, 245, No. 1 ; and fig. 14, pl. 62, in vol. VIII, 1806. [v. *Spirolina.*]

——— ——— ——— Lamarck, Coq. Foss. Paris, 1823, 14, xiv, 14.

——— **lyelli**, Mantell. Wonders Geol. 1848, 6th ed. 325, fig. 60[1]. [= *Lituola nautiloidea*, q. v.]

——— **murchisoni**, Mantell. Wonders Geol. 1848, 6th ed. 325, fig. 60[2]. [= *Placops. irregularis*, q. v.]

——— **omninorecta**, Lamarck, MS. Vélins du Muséum Paris, No. 22, fig. 27.

——— Bowdich, Elem. Conch. Pt. 1, 1822, 21, i, 13. [*Peneroplis* and *Spirolina* both fig'd.]

SPIROLINITES, Northampton. Proc. geol. Soc. Lond. II, 1838, 685, 686. [= *Lituola.*]
——— Mantell, Medals Creation, ed. 2, 1854, 349, fig. 112, 1, 2, 3, 4.
——— see *Spirolina.*
SPIROLOCULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 298 ; Brady, Report Challenger, 1884, 147.
——— **acutimargo**, Brady. Report Challenger, 1884, 154, x, 12–15.
——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 323, fig. 1*a*, *b*, *c*.
——— **affixa**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 55, v (x), 13*a–c*.
——— **alata**, Reuss. Neues Jahrbuch, 1853, 671, ix, 1.
——— **alata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 158, xvi (xxiv), 17 and 18.
——— **ambullaris**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 428.
——— **ampla**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 132, xvii, 10*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— **angulifera**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 156, xvi (xxiv), 9-15.
——— **angulosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 298, No. 9.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], I, 1878, 53, v (x), 7*a*, *b*.
——— **angulosa**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 132, xvii, 9*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— **antillarum**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 166, ix, 3 and 4 ; also in Spanish, 1840, 149, same pl. and fig.
——— ——— ——— Brady, Report Challenger, 1884, 155, x, 21*a*, *b*.
——— **arenaria**, Brady. Report Challenger, 1884, 153, viii, 12.
——— **aspera**, Terq. et Berth. Mém. Soc. géol. France, [2], x, 1875, 83, vii (xvii), 6*a–c*.
——— **asperula**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 136, i, 10.
——— ——— ——— Brady, Report Challenger, 1884, 152, viii, 13, 14, and 11 ?
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 214, xl, 28, 29.
——— **badenensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 270, xvi, 13–15.
——— [**badensis**] ——— Zittel, Handbuch Palaeont., Abth. I, 1876, 77, fig. 10^3.
——— [**badensis**] ——— Hoernes, Elem. Palaeont. 1884, 34, fig. 30 ; French ed. 1886, same fig.
——— **berchtoldsdorfensis**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 375, xvi, *a*, 10.
——— **berthelotiana**, Reeve. Conch. System. II, 1842, 290, ccxcvii, 6. [*Quinqueloculina*, d'Orb. = *Quinqueloc.*]
——— **bicarinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 298, No. 6.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 155, xvi (xxiv), 5*a*, *b*.
——— (cf.) ——— ——— Schwager, Palaeontographica, XXX, 1883, Pal. Theil, 85, xxiv (i), 4*a–c*.
——— **birmensdorfensis** (K. & Z.). Haeusler, Neues Jahrb. 1887, I, 194, vii, 42. [*Ophthalmidium*, 1870.]
——— **canaliculata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 269, xvi, 10–12.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 312, xxiv, 11*A*, *C* [error for 98, 10].
——— ——— ——— Pictet, Traité de Paléont. 2 ed. IV, 1857, 524, cix, 43.
——— ——— ——— Mackie, Recreative Science, I, 1859, 149, fig. 31.
——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, 16, iii, 39 and 40.

SPIROLOCULINA depressa, d'Orbigny. = *S. planulata* (Lam.); see *Frumentaria sigma*, etc., and *F.* 6 *speciei.*

——— **desertorum**, Schwager. Palaeontographica, xxx, 1883, Pal. Theil, 84, xxiv (1), 2*a*–*c*.

——— **dilatata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 271, xvi, 16–18.

——— ——— ——— Reuss' Models, No. 81, 1865 (Catal., No. 18, 1861).

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 3, 1881, 133, xvii, 13*a*, *b*; (and Mém. Soc. Dunkerquoise).

——— **dilatata**, Ehrenberg. Mikrogeologie, 1854, xxiv, 64.

——— **disparilis**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 55, v (x), 12*a*–*c*.

——— **dorsata**, Reuss. Sitz. k. Ak. Wiss. Wien, LXII, 1870, 464; v. Schlicht, Foram. Septar. Pietzpuhl, 1870, xxxvii, 24–32.

——— **dubia**, Roemer. Neues Jahrbuch, 1838, 392, iii, 69.

——— **dubiensis**, Deecke. Mém. Soc. Emul. Montbéliard, XVI, 1886, [17], i, 19, 19*a*, 26–26*b*.

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——— **elongata**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 96; and Mikrogeologie, 1854, xix, 97. [= *S. planulata*, Lam.]

——— **elongata**, Neugeboren. Verh. Mitth. siebenburg. Ver. Nat. Jahrg. xx, 1869, 26, no fig.

——— **excavata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 271, xvi, 19–27 [error for 19–21].

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——— **foliacea**, Schwager. Boll. R. Com. geol. Ital. IX, 1878, 529, i, 20.

——— **fragilissima**, Brady. Report Challenger, 1884, 149, ix, 12–14.

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——— **grata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 55, v (x), 14*a*–15*b*.

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——— **pertusa**, Terq. Mém. Soc. géol. France, [3], II, 1882, 160, xvi (xxiv), 27*a*, *b*.
——— **planulata** (Lamarck). See *Miliolites*, 1804.
——— ——— ——— Macdonald, Ann. Mag. Nat. Hist. [2], XX, 1857, 193, vi, 28.
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——— ——— ——— See *Frumentaria sigma*.
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——— **rostrata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 382, xlix, 7.
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——— **[rotundata]** ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 248, viii, 25
——— ——— ——— Terq., Mém. Soc. géol. France, [3], I, 1878, 54, v (x), 10*a*, *b*.
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——— **semi-ornata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 161, xvi (xxiv), 28*a*, *b*.
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——— **striata**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 160, xvi (xxiv), 26*a*–*c*.
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Spirolocunina, Stohr, 1877. Misprint for *Spiroloculina*.
SPIROPLECTA, Ehrenberg, 1844. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 75 ; Brady, Report Challenger, 1884, 375.
——— **abyssorum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 293.
——— **americana**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 35. [*Heterohelix*, 1843.] [= *Text. gibbosa.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, i, 13 and 14. [*Heterohelix*, 1843.] [= *Text. striata* with spiral growth.]
——— ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 175, vii, 6.
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——— **biformis** (Park. & Jones). Brady, Report Challenger, 1884, 376, xlv, 25–27. [*Textularia agglutinans*, v. *biformis*, 1865.]
——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 333, xiii, 21, fig. 2.
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——— **demersa**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 294.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), vii, 26.
——— **nana**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 17.
——— **prælonga** (Reuss). Wright, Proc. Belfast Nat. Field Club, 1884–85, App. IX, 1886, 329, xxvii, 3. [*Textularia*, 1845.]
? ——— **propendissima**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 294.
——— **rosula**, Ehr. Mikrogeologie, 1854, xxxii, ii, 36. [Stands ; = *Text. biformis*, P. & J., when sandy, *T. complexa*, H. B. B., when clear ; see Parker & Jones, Ann. Mag. Nat. Hist. x, 1872, 198.]
? ——— Ehrenberg, Abhandl. k. Ak. Wiss. Berlin, 1855, 169, iv, xiii. [= *Spiroplecta.*] [Glauc.]
——— Bronn, Klassen Ordn. Thier-Reichs, I, 1859, 69, viii, 3. [Sarcode.]
SPIROPLEURITES nebulosus, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 248.
——— ——— ——— Mikrogeologie, 1854, xxxv, *B*, iv, 7. [= *Pulvin. repanda.*]
——— **platystomus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 248.
SPIROSPHÆRINA, Deshayes, 1830. See *Globulina*, Deshayes.
SPIROSTEGINA, Zborzewski. Bull. Soc. Imp. Nat. Moscou, XVI, 1843, 363, fig. *f*. [= ? Chara.]
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? ——— **tenella**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 167.
SPORILUS, Montfort. Conch. syst. I, 1808, 43, 11th genre. [= *Polyst. strigillata*, var.]
SQUAMULINA, Schultze, 1854. Organismus Polythal. 1854, 56.
——— **lævis**, Schultze. Organismus Polythal. 1854, 56, vi, 16 and 17.
[**SQUAMMULINA**] ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 67, i, 22. [= ? young *Nubecularia*.]

STREBLUS tortuosus, Fischer. Mém. Soc. Imp. Nat. Moscou, v, 1817, 449, xiii, 5. [= *Rotalia beccarii.*]
Striata, Green, 1881. = *Lagena striata.*
STROMATOCERIUM, Hall, 1847. Palaeont. New York, I, 1847, 48.
——— **richmondense**, S. A. Miller. Journ. Cincin. Soc. Nat. Hist. v, 1882, 41. [Nicholson, Geol. Mag. dec. 3, vol. v, 1888, 24, states that this fossil is a species of *Girvanella.*]
Strombus lapideus. Gesner, De omni rerum, etc. 1565, 170, f. 1. [? a *Vaginulina.*]
STROPHOCHETUS, H. M. Seely, 1885. Amer. Journ. Sci. xxx, 1885, 355. [Referred by G. J. Hinde to *Girvanella*, Geol. Mag. dec. 3, vol. IV, 1887, 227; described by Seely as a free calcareous sponge] : see also Nicholson, Geol. Mag. dec. 3, vol. v, 1888, 24.
——— **ocellatus**, H. M. Seely. Amer. Journ. Sci. xxx, 1885, 357, figs. 1, 2, and 3.
STROPHOCONUS, Ehrenberg, 1843. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 166.
? ——— **(Grammost. ?) acanthopus**, Ehr. Mikrogeologie, 1854, xxvi, 23. [= *Virg. hemprichii.*]
? ——— **africanus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 68 and 96; and Mikrogeologie, 1854, xxi, 88. [= *Virg. hemprichii.*]
——— **arcticus**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 294.
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 13.
——— **auricula**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
——— ——— ——— Ehr., Mikrogeologie, 1854, xx, ii, 2. [= *Virg. schreibersii.*]
——— **cepa**, Ehr. Mikrogeologie, 1854, xxix, 33; and xxx, 21. [= *Virg. hemprichii.*]
——— **cribrosus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 167, 272.
——— **efflorescens**, Ehr. Mikrogeologie, 1854, xxvi, 24. [= *Virg. hemprichii.*]
——— ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 17. [= *Virg. squamosa.*]
——— **falcatus**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 294.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), iv, 15.
——— **flosculus**, Ehr. Mikrogeologie, 1854, xxix, 34. [= *Virg. hemprichii*, var.]
——— **fundicola**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.
——— ——— ——— Ehrenberg, Abh. k. Ak. Wiss. Berlin, 1872 (1873), v, 16.
——— **gemma**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 376.
——— ——— ——— Ehr., Mikrogeologie, 1854, xxix, 35. [= *Virg. hemprichii*, var.]
——— ——— ——— Ehr., Mikrogeologie, 1854, xx, ii, 5. [= *Virg. schreibersii*, approaching *Bulim. elegantissima.*]
——— **gibbus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1843, 272.
——— ——— ——— Ehr., Mikrogeologie, 1854, xx, ii, 4. [= *Virg. schreibersii.*]
——— **gracilis**, Ehr. Mikrogeologie, 1854, xxix, 36. [= *Virg. hemprichii*, var.]
——— **græcus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1844, 96; and Mikrogeologie, 1854, xix, 86. ["*Textil. aciculata?* of 1838;" = *Virgulina schreibersii* vel *hemprichii.*]
? ——— **hemprichii**, Ehr. Mikrogeologie, 1854, xxiv, 32. [= *Virgulina.*]
——— **hyperboreus**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1872, 295.
——— ——— ——— Ehrenberg, in Koldewey, Zweite deutsche Nordpolarfahrt, 1874, II, n. d., i, 12.
? ——— **(Grammost. ?) leptoderma**, Ehr. Mikrogeologie, 1854, xxiv, 28 and 30. [= *Virg. hemprichii.*]

TECHNITELLA melo, Norman. Ann. Mag. Nat. Hist. [5], I, 1878, 280, xvi, 5 and 6.
——— ——— ——— Brady, Report Challenger, 1884, 246, xxv, 7*a*, *b*.
——— ——— ——— De Folin, Le Naturaliste, Ann. 10, 1888, 109, fig. 3.
——— **raphanus**, Brady. Report Challenger, 1884, 247, xxv, 13 and 14.
——— de Folin, Bull. Soc. N. H. Toulouse, xv, 1881, 141, 1 n. sp. proposed but not described. [*T. cristata.*]
TEREBRALINA, Terquem, 1866. Sixième Mém. Foram. Lias, 1866, 473.
——— **regularis**, Terquem. Sixième Mém. Foram. Lias, 1866, 473, xix, 3. [Cfr. *Ammodiscus* [*Trochamm.*] *shoneana*, Siddall.]
TETRAGONULINA, Seguenza, 1862. Foram. monotal. miocen. Messina, 1862, 53.
——— **prima**, Seguenza. Foram. monotal. miocen. Messina, 1862, 53, ii, 54 and 55.
TETRATAXIS, Ehrenberg, 1843. Ber. k. preuss. Ak. Wiss. Berlin, 1843, 106.
——— **conica**, Ehr. Ber. k. preuss. Ak. Wiss. Berlin, 1843, 106; and Mikrogeologie, 1854, xxxvii, xi, *A–D*, 12. [("Compare *Textil. palæotrochus*") = *Valvulina*, q. v.]
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——— ——— ——— v. **gibba**, v. Moeller. Mém. Ac. Imp. Sci. St. Pétersbourg, [7], XXVII, No. 5, 1879, 73, ii, 4*a–c*; vii, 3.
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Testa fossilia kahirensia. Forskal, Descr. Anim. 1775. [= *Nummulites.*]
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Textiraria. Amer. Cyclopaedia, 1883; see *Textularia.*
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——— **abbreviata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 249, xv, 9–12 [error for 7–12].
——— ——— ——— Egger, Neues Jahrbuch, 1857, 293, xii, 17 and 18.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 190, i, 23.
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——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VI, 1887, 399, xi, 1*a*, *b*, 3*a*, *b*.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 219, xlii, 4 and 5.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 109, v, 3.

[* Many Continental authors prefer to use *Textilaria* instead of *Textularia*. In all cases where this spelling is adopted an asterisk has been placed at the end of the generic reference, the compiler having considered it advisable not to separate the references into the two arrangements of *Textilaria* and *Textularia*.]

TEXTULARIA abbreviata, d'Orbigny. See *Nautili amphorarii*, and *Nautilus amphorarius*.

——— ——— ——— See *T. agglutinans*, d'O.

——— **aciculata**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 263, No. 15, xi, 1–4.

——— ——— ——— Smedley, Ency. Metrop. 1845, undescr., pl. "Mollusca ?," 16–19.

——— ——— ——— Eley, Geol. in the Garden, 1859, 195, iii, 13 and 14. [Flint cast.]

——— ——— ——— Cooke, Thousand Objects Microsc. 1869, 90, ix, 13.

——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, xxxiii, 1880, 191, ii, 24–27.

——— **aciculata** ?, Ehr. Abhandl. k. preuss. Ak. Wiss. Berlin, 1838, 134, iv, ii, vii, xii, 8.

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1839, 135, ii, v; Taylor's Scientific Memoirs, iii, 1843, 358, vi, 5. [= *Bolivina dilatata* (?), Rss.]

——— ——— ——— Harting, Magt van het Kleine, 1849, 119, figs. 2 and 3; and 1866, 113, fig. 48, 2 [*Textilaria*]; German by Dr. A. Schwartzkopf, 1851, 87, fig. 39, 2 and 3.

——— ——— ——— Mantell, Quart. Journ. Geol. Soc. vi, 1850, 330, xxix, 3.

———* **aculeata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429.

———* ——— ——— Ehr., Mikrogeologie, 1854, xxviii, 18; xxxi, 17; and xxxviii, xxiii, 5. [= *T. subangulata*, d'O.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 8. ("*T. aspera*, 1838, in part.") [= *T. subangulata*, d'O.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxix, 20*a*, *b*. [20*a* = *T. gibbosa*; 20*b* = *Boliv. punctata*, v. *aculeata*, Ehr.]

——— **acuta**, Costa. Atti Accad. Pontaniana, vii, fas. 2, 1856, 294, xxiii, 13 and 14.

——— **acuta**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 262, No. 9.

———* ——— ——— Ehr., Mikrogeologie, 1854, xxx, 7. [= *Virg. reussii*, Gein. = *Boliv. punctata*.]

——— **acuta**, Reuss. Denkschr. k. Ak. Wiss. Wien, i, 1850, 381, xlix, 1.

———* ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1059, lxxxvi, 60.

———* **æquilateralis**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 19, iii, 12.

——— **agglutinans**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 144, i, 17, 18; 32–34; also in Spanish, 1840, 136, same pl. and fig.

——— ——— ——— var. Jones, Geologist, vi, 1863, 294, xv, 4 and 5.

——— ——— ——— Parker & Jones, Phil. Trans. 1865, 369, xv, 21.

——— ——— ——— v. **abbreviata**, d'O. Parker & Jones, Phil. Trans. 1865, 369, xvii, 76*a*, *b*. [v. *T. abbreviata*.]

——— ——— ——— v. **biformis**. Parker & Jones, Phil. Trans. 1865, 370, xv, 23 and 24. [v. *Spiroplecta* and *T. biformis*.]

——— ——— ——— v. (**Bigenerina**) **digitata**, d'O. Parker & Jones, Phil. Trans. 1865, 371, xvii, 81. [v. *B. digitata*.]

——— ——— ——— v. (**Bigenerina**) **nodosaria**, d'O. Parker & Jones, Phil. Trans. 1865, 371, xv, 25; xvii, 80*a*, 80*b*. [v. *B. nodosaria*.]

——— ——— ——— v. **carinata**, d'O. Parker & Jones, Phil. Trans. 1865, 370, xvii, 79*a*, *b*. [v. *T. carinata*.]

——— ——— ——— v. **pygmæa**, d'O. Parker & Jones, Phil. Trans. 1865, 370, xv, 22; xvii, 78*a*, *b*. [v. *T. pygmæa*.]

——— ——— ——— v. **sagittula**, Defr. Parker & Jones, Phil. Trans. 1865, 369, xvii, 77*a*, *b*. [v. *T. sagittula*.]

——— ——— ——— v. (**Verneuil.**) **polystropha** (Rss.). Parker & Jones, Phil. Trans. 1865, 371, xv, 26. [v. *V. polystropha*.]

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TEXTULARIA agglutinans, d'O. Tate & Blake, Yorkshire Lias, 1876, 472, xvii, 37.

———* ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 93, ix, 1–8. [Structural.]

——— ——— ——— Hamilton, Trans. N. Zealand Inst. XIII, 1881, 395, xvi, 10.

——— ——— ——— v. (**Bigenerina**) **nodosaria**, d'Orb. Hamilton, Trans. N. Zealand Inst. XIII, 1881, 395, xvi, 11. [v. *B. nodosaria.*]

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——— **agglutinans**, Seguenza. Atti Accad. Gioenia Sci. Nat. [2], XVIII, 1862, 114, ii, 4, 4*a*.

———* **alpina**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 19, iii, 11 and 19.

———* **alsatica**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 306, vi, 5.

———* **americana**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429.

———* ——— ——— Ehr., Mikrogeologie, 1854, xxxii, i, 4*a*, and 7. [= *T. striata.*]

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 175, vii, 1 and 7 ?

———* **ampliata**, Ehr. Mikrogeologie, 1854, xxviii, 8. [= *T. gibbosa*, d'O.]

———* **amplior**, Ehr. Mikrogeologie, 1854, xxxi, 11. [= *T. globulosa*, Ehr.]

——— **anceps**, Reuss. Verstein. böhm. Kreide, 1845–46, i, 39, viii, 79; xiii, 78.

———* ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XL, 1860, 234, xiii, 2*a*, *b*.

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——— ——— ——— Eley, Geol. in the Garden, 1859, 196, iii, 15. [Flint cast.]

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——— **annectens**, Parker & Jones. Ann. Mag. Nat. Hist. [3], XI, 1863, 92, fig. 1. [v. *Spiroplecta.*]

——— ——— ——— Jones, in Micrógr. Dict. ed. 4, 1883, 763, xxiii, 52.

———* **angusta**, Terquem. Six. Mém. Foram. Lias, 1866, 527, xxii, 24*a*, *b*.

———* **argus**, Harting. Verh. Kl. Koninkl.-Nederland. Inst. [3], IV, 1852, 115, ii, 6.

———* **areolata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429.

——— **articulata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 250, xv, 16–18.

——— **articulata**, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 45, iv, 14.

——— **aspera**, Brady. Proc. Roy. Soc. Edinburgh, XI, 1882, 715, not figured.

——— ——— ——— Brady, Report Challenger, 1884, 367, xliv, 9–13.

——— **aspera**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 134, iv, iv, v, γ.

———* **aspera**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 147, xv, (xxiii), 14.

——— **atlantica**, Bailey. Smithsonian Contrib. II, 1851, 12, pl., 38–43.

TEXTULARIA clypeata, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 295, xxiii, 4*A*, *B*, *C*.

———* **cognata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVIII, Abth. 1, 1863 (1864), 68, viii, 96*a*, *b*.

——— **communis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 263, No. 27.

——— **complexa**, Brady. Nat. Hist. Trans. Northumb. I, 1865–67 (1867), 101, xii, 6*a*, *b*.

——— **compressa**, Roemer. Neues Jahrbuch, 1838, 384, iii, 13.

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 281, i, 12.

——— **concava** (Karr.). Brady, Report Challenger, 1884, 360, xlii, 13, 14; and xliii, 11. [*Plecanium*, 1868.]

———* **concava**, Terq. et Berth. Mém. Soc. géol. France, [2], x, 1875, 62, v (xv), 8*a–c*.

——— **concinna**, Reuss. Verstein. böhm. Kreide, 1845–46, II, 109, xxiv, 54.

——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, VII, Abth. 1, 1854, 71, xxvi, 6.

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——— **conica**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 143, i, 19 and 20; also in Spanish, 1840, 135, same pl. and fig.

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——— **conica**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 135.

——— **consecta**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 7.

——— **conuloidea**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, xxiii, 12.

——— **conulus**, Reuss. Geogn. Skizze Böhmen, II, 1844, pt. 1, 215.

——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 38; viii, 59; xiii, 75.

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 680, xxiv, 73.

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———* ——— ——— Reuss' Models, No. 40, 1865 (Catal., No. 75, 1861).

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———* **convexa**, Karrer. Novara-Exped., Geol. Theil I, 1864, 78, xvi, 8.

——— **cordata**, Meneghini (in litt. 1856). Fornasini, Boll. Soc. geol. Ital. VII, 1888, 318, xi, 2–5.

———* **cordiformis**, Schwager. Jahresh. Ver. vat. Nat. Württ. XXI, 1865, 139, vii, 15.

———* ——— ——— Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [36], i, 31, 31*a*.

———* **cordiformis**, Terquem. Cinq. Mém. Foram. Oolithique, 1883, 384, xlv, 5*a*, *b*.

——— **corrugata**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 125, i, 15.

——— **crassa**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 293, xxiii, *A*, *B*, [fig. 6].

——— **crispata**, Brady. Report Challenger, 1884, 359, cxiii, 2*a*, *b*.

——— **cuneiformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 263, No. 18.

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——— ——— ——— Williamson, Recent British Foram. 1858, 74, vi, 158–161, "158 and 159 typica."

——— ——— ——— v. **conica**, d'Orb. Williamson, Recent British Foram. 1858, 75, vi, 160 and 161. [v. *T. conica*.]

TEXTULARIA cuneiformis, d'Orbigny. Cooke, Thousand Objects Microsc. 1869, 93, ix, 24.

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——— **cuneiformis**, Jones, MS. Mantell, Quart. Journ. Geol. Soc. VI, 1850, 330, xxix, 1.

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——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 763, xxiii, *47a, b.*

——— **deltoidea**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 381, xlix, 4.

——— **dentata**, Alth. Haidinger's Naturw. Abh. III, Abth. 2, 1850, 262, xiii, 13.

——— **deperdita**, d'Orbigny. Foram. Fossiles Vienne, 1846, 244, xiv, 23–25.

——— ——— ——— Harting, Magt van het Kleine, 1849, 111, fig. 5; and 1866, 103, fig. 43; German by Dr. A. Schwartzkopf, 1851, 81.

——— ——— ——— Mackie, Recreative Science, I, 1859, 148, fig. 27.

———* ——— ——— Schlumberger, Feuille Jeun. Nat., Feb. 1882, ii, 1.

———* **depressa**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 16, iii, 7.

——— **digitata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 5.

——— **dilatata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 135, iv, ix, δ.

———* ——— ——— Ehr., Mikrogeologie, 1854, xxix, 19. [= *T. gibbosa.*]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxvii, 5. ["*T. brevis ?* 1838."] [= *T. striata*, Ehr.]

———* ——— ——— Harting, Magt van het Kleine, 1849, 119, fig. 4; and 1866, 113, fig. 48[3]; German by Dr. A. Schwartzkopf, 1851, 87, fig. 39, 4. [*Textularia.*]

———* **dumortieri**, Schwager. Benecke's Geogn. Pal. Beiträge, I, 1866, 309, fig. 14.

——— **echinata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 263, No. ?

——— ——— ——— = *Bulim. aculeata*, d'O.; see *Polymorpha pineiformia.*

——— **ehrenbergii**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 97, xv, 16.

——— **elata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 290, xxiii, 9.

——— **elliptica**, Roemer. Neues Jahrbuch, 1838, 384, iii, 18.

——— **elongata**, Cornuel. Mém. Soc. géol. France, [2], III, 1848, 258, ii, 25.

——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 263, No. 11.

———* **elongata**, Ehrenberg. Abh. k. Ak. Wiss. Berlin, 1872 (1873), xii, 9.

———* **elongata**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 57, xv, 3; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 67, same pl. and fig.

——— **elongata**, v. Hagenow. Neues Jahrb. 1842, 570.

——— **elongata**, Jones, MS. Mantell, Quart. Journ. Geol. Soc. VI, 1850, 330, xxix, 2.

——— ——— ——— Mantell, Medals Creation, ed. 2, 1854, 361, fig. 119[3]. [Sarcode.]

———* **euryconus**, Ehr. Mikrogeologie, 1854, xxxii, i, 9. [= *T. gibbosa.*]

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 161, ii, iv, 175, vii, 8. [= *T. agglutinans.*]

[**TEXTILLARIA**]* **exigua**, Schwager. Dittmar, Die Contorta-Zone, 1864, 200, iii, 12.

——— ——— ——— See *T. pusilla.*

———* **eximia**, Eichwald. Lethaea Rossica, I, 1860, 355, xxii, *19a–d.*

——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 132, x, 27–29.

———* **falcata**, Ehr. Mikrogeologie, 1854, xxxvii, xi, *A–D*, 14. [Edge view of *T. recurvata*, xxxvii, xi, *A–D*, 17.]

[**TEXTULARIA**]* **faujasi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 320, iii, 9*a*, *b*.
———* **flabelliformis**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 647, ii, 83*a*, *b*.
———* **flesus**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 376.
———* **flexa**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 35, IV, Impressathon, 17, 17*a*.
——— **fœda**, Reuss. Verstein. böhm. Kreide, 1845–46, ii, 109, xliii, 12 and 13.
——— **folium**, Park. & Jones. Phil. Trans. 1865, 370, xviii, 19.
——— ——— ——— Möbius, Beitr. Meeresfauna Insel Mauritius, etc. 1880, 92, viii, 16 and 17.
——— ——— ——— Brady, Report Challenger, 1884, 357, xlii, 1–5.
———* **franconica**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 229, iv, 18*a*, *b*.
——— **fungiformis**, Fornasini. Boll. Soc. geol. Ital. VI, 1887, 387, x, 1*a*, *b*.
——— **geinitzi**, Richter. In Geinitz, Dyas, etc. Heft I, 1861, 123, xx, 39.
——— **gibbosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 6.
——— ——— ——— D'Orbigny, Modèles, No. 28, 1826. [v. *Plecanium.*]
——— ——— ——— P., J., & B. [d'O., Modèles, No. 28], Ann. Mag. Nat. Hist. [3], XVI, 1865, 23, ii, 60.
——— ——— ——— J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., iii, 10–13.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 167, xi, 115. [See *T. obtusa*, d'O.]
——— ——— ——— Idem, 167, xi, 116. [See *T. lævigata*, d'O.]
——— ——— ——— Idem, 167, xi, 117. [See *T. punctulata*, d'O.]
——— ——— ——— Idem, 168, xi, 118.
——— ——— ——— Idem, 169, xi, 119. [See *T. tuberosa*, d'O.]
——— ——— ——— Idem, 169, xi, 120. [See *T. caudata*, d'O.]
——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 131, x, 26.
——— ——— ——— forma **Bigenerina**. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 79, v, 162–164.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.
——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VI, 1887, 160, ii, 1*a*, *b*.
——— ——— ——— Malagoli, Atti Soc. Nat. Modena, (Rend.) [3], III, 1887, 108, i, 2.
——— ——— ——— See *Polymorpha janiformia*, and *Nautili amphorarii.*
———* **gigas**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 18, iii, 9.
———* **globifera**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 232, xiii, 7*a*, *b*, 8.
——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 90, fig. 27[1].
———* **globigera**, Schwager. Novara-Exped., Geol. Theil II, 1866, 252, vii, 100.
———* **globigera**, Terq. et Berth. Mém. Soc. géol. France, [2], x, 1875, 64, v (xv), 13.
———* **globigerina**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 19, iii, 13.
———* **globosa**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 58, xv, 5 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 67, same pl. and fig. [*T. globulosa* in descr. of plate.]
——— **globulosa**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 135, iv, fig. β frequens.
———* ——— ——— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1844 ; and Mikrogeologie, 1854, xxi, 87. [= *T. gibbosa.*]
——— ——— ——— Bailey, in Hitchcock, Report 1, 2, and 3 Meeting Assoc. Amer. Geol. and Nat. 1843, 357, xiii [error for xv], 1, 3, 4, 5, 7.
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 39, xii, 23.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 681, xxiv, 74.

TEXTULARIA globulosa, Ehr. Williamson, Mem. Lit. Phil. Soc. Manchester, [2], viii, 1848, 76, pl., 61.

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———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1847, 446, ii, 78, 79; iii, i, 76; v, ii, 111; vi, iii, 59 ?, 80. [79, *T. carinata*, d'O.; 59, *T. gibbosa*, d'O.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxxvii, vi, 6; and xxxviii, xxiii, 3.

———* ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 8; v. *amplior*, 9 and 11. [= *T. globulosa*, Ehr.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxxix, 140. [= *T. globulosa*, or *T. gibbosa ?*]

———* ——— ——— and vars. **obtusa** (4), **amplior** (5), **dilatata** (6), Ehr. Mikrogeologie, 1854, xxiii, 3–6. [= *T. globulosa*, Ehr.]

———* (**globulosa-ampliata**), Ehr. Mikrogeologie, 1854, xxxi, 12 and 13; and xxxvii, vi, 7. [= *T. globulosa*, Ehr.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 13. [Near *T. agglutinans*.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxxvii, vii, 12. [A cast; ind.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxiv, 13 and 14; xxvii, 6; xxix, 17*a*, *b*; xxx, 3*a*, *b*; xxxii, i, 8; xxxii, ii, 12 and 13. [= *T. gibbosa*, d'O.]

———* (**globulosa-ampliata**), Ehr. Mikrogeologie, 1854, xxviii, 12. [= *T. gibbosa*.]

———* ——— γ **amplior**, Ehr. Mikrogeologie, 1854, xxiv, 12. [= *T. gibbosa*, d'O.]

———* ——— β **obtusa**, Ehr. Mikrogeologie, 1854, xxvi, 9 and 10. [= *T. gibbosa*.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxviii, 9 and 10. [= *T. gibbosa*, arrested.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxxix, xiv, *g*. [= *T. gibbosa*, vel *Globigerina*.]

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 161, ii, i. [Glauc.]

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 175, vii, 9.

———* ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 173, vi, i, *a*. [Glauc.]

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——— ——— ——— Eley, Geol. in the Garden, 1859, 194, ii, 9. [Flint cast.]

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———* ——— ——— Kübler & Zwingli, Neujahrsblatt Bürgersbibl. Winterthur, 1866, 18, iii, 16.

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——— ——— ——— Greene, Man. Protozoa, 1871, 15, fig. 3*f*.

——— ——— ——— G. M. Dawson, Canad. Nat. [2], vii, 1874, 253, fig. *a*.

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——— ——— ——— Dawson, Proc. Amer. Assoc. 1876 (Detroit), 104, fig. 4*a*.

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[TEXTULARIA*] **globulosa**, Ehr. Dawson, Lecture Notes, 1880, 92, fig. 6*a*. [= *T. striata.*]

——— ——— ——— American Cyclopaedia, VII (1883), 311, fig. 1.

——— ——— ——— Woodward & Thomas, 13 Ann. Rep. Geol. N. H. Survey Minnesota for 1884 (1885), 166, iii, 1–5.

———* ——— ——— Fritsch, Arch. Nat. Landesd. Böhmens, VII, 1889, 116, woodcut 163.

———* **gomphoconus**, Ehr. Mikrogeologie, 1854, xxxii, i, 10. [= *T. gibbosa.*]

——— **gracilis**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 384, iii, 14.

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 281, i, 13.

———* **gracillima**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 235, viii, 9.

——— **gramen**, d'Orbigny. Foram. Fossiles Vienne, 1846, 248, xv, 4–6.

——— ——— ——— Brady, Report Challenger, 1884, 365, xliii, 9 and 10.

——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 332, xiii, 13 and 14.

——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VI, 1887, 399, xi, 4*a*, *b*.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 109, v, 1, 2.

———* **grammostomum**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.

——— **granulata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, n. d., xv, 4.

? ———* **groenlandica**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.

——— **hauerii**, d'Orbigny. Foram. Fossiles Vienne, 1846, 250, xv, 13–15.

———* **hayi**, Karrer. Novara-Exped., Geol. Theil I, 1864, 78, xvi, 7.

———* **helveto-jurassica**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 30, iii, 45 ; and 39, iv, Badener Schicht, 10.

———* **hemisphærica**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 16, iii, 5.

———* **heteroclita**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 146, xv (xxiii), 11*a*, *b*.

——— **inconspicua**, Brady. Report Challenger, 1884, 357, xlii, 6*a*, *b*, *c*.

———* **incrassata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429.

———* **inflata**, Ehr. Mikrogeologie, 1854, xxx, 12. [" *T. aspera*, 1838, partly."] [= *T. subangulata*, d'O.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxiv, 15. [= *T. gibbosa*, d'O.]

———* ——— ——— Ehr., Mikrogeologie, 1854, xxv, i, *A*, 10. [= *T. globulosa*, Ehr.]

———* **inflata**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 306, vi, 6.

? ———* **initiatrix**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 307, 337, i, iii. [Glauconite.]

———* **inversa**, Terquem. Mém. Soc. géol. France, [3], IV, 1886, 60, vii, 6*a*, *b*.

——— **jonesi**, Brady. Carbonif. Foram., Pal. Soc. XXX, 1876, 133, x, 20–22.

——— ——— ——— Roemer, Lethaea Geognostica, Th. I, Lief. 1, 1880, 272, fig. 44.

——— **jugosa**, Brady. Report Challenger, 1884, 358, xlii, 7*a*, *b*.

———* **jurassica**, Gümbel. Jahresh. Ver. vat. Nat. Württ. XVIII, 1862, 228, iv, 17*a*, *b*.

———* **labiata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 362, ii, 17*a–c*. [v. *Plecanium.*]

——— **labiata**, Reuss. Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 11, ix, 1*a–c*.

——— **lacera**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 84, vi, 52 and 53.

——— **lævigata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 2.

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 243, xvi, 14–16.

[TEXTULARIA] **obsoleta**, Reuss. Verstein. böhm. Kreide, 1845–46, I, 39, xiii, 79.

—— —— —— Eley, Geol. in the Garden, 1859, 202, viii, 11*C*.

—— —— (?) —— Eley, Geol. in the Garden, 1859, 195, ii, 11. [Flint cast.]

——* —— —— Reuss, Sitz. k. Ak. Wiss. Wien, LII, Abth. 1, 1865 (1866), 455, pl., 8.

—— **obtusa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 1.

—— —— —— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 188, iii, 29 and 30.

—— —— —— = *T. gibbosa*, d'O. ; see *Polymorpha pineiformia*.

—— **obtusangula**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 97, xv, 18.

—— —— —— Reuss, Verstein. böhm. Kreide, 1845–46, i, 38 ; viii, 58.

——* **ocellata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 443, iii, vii, 44. [= *Boliv. dilatata*, Rss.]

——* **oolithica**, Terquem. Cinq. Mém. Foram. Oolithique, 1883, 384, xlv, 6.

——* **ovalis**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 16, iii, 6.

—— **ovata**, Roemer. Neues Jahrbuch, 1838, 384, iii, 17.

—— **oviformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 8.

——* **oxfordiana**, Deecke. Mém. Soc. Emul. Montbéliard, XVI, 1886, [36] i, 24, 24*a*.

——* **pachyaulax**, Ehr. Mikrogeologie, 1854, xxix, 21*a* ; and xxx, 5*a*, *b*. [Compare *T. brevis*.] [= *T. striata*, Ehr.]

—— **pala**, Czjzek. Haidinger's Naturw. Abh. II, 1848, 148, xiii, 25–27.

——* **palæotrochus**, Ehr. Mikrogeologie, 1854, xxxvii, x, *A*, 1–4. [v. also *Valvulina*.]

—— **palmata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 293, xxiii, 21*A*, *B*, *C*.

——* **parallela**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 233, xii, 7*a*, *b*.

—— **partschii**, Czjzek. Haidinger's Naturw. Abh. II, 1848, 148, xiii, 22–24.

—— **partschii**, Reuss. Verstein. böhm. Kreide, 1845–46, I, 39 ; xiii, 80.

——* [**partschi**] —— Reuss, Sitz. k. Ak. Wiss. Wien, XL, 1860, 233, xiii, 6*a*, *b*.

—— **pectinata**, Reuss. Denkschr. k. Ak. Wiss. Wien, I, 1850, 381, xlix, 2 and 3.

——* —— —— Reuss, Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 157, iv, 12 and 13.

——* —— —— Reuss, Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 98, iii, 11*a*, *b*.

—— **perforata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 135, iv, xi, ε.

——* —— —— Ehr., Bericht k. preuss. Ak. Wiss. Berlin, 1844, 68 ; and Mikrogeologie, 1854, xxii, 80. [Obscure ; ? *Globigerina*.]

—— **pennatula**, Batsch, var. **aculeata**, Ehr. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 79, v, 165, 166. [*Nautilus*, 1791.]

—— **peucetia**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 295, xxiii, 7*A*, *B*, *C*.

——* **picta**, Schultze. Organismus Polythal. 1854, 62, vii, 25–27.

——* **pikettyi**, Terquem. Six. Mém. Foram. Lias, 1866, 527, xxii, 23*a*, *b*, *c*.

—— **plana**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 263, No. 14.

——* **pleuronectes**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 377.

—— **ponderosa**, Fornasini. Boll. Soc. geol. Ital. VI, 1887, 399, xi, 5*a*, *b*, 6*a*, *b*.

——* **poroconus**, Ehr. Mikrogeologie, 1854, xxxii, i, 6. [= *T. gibbosa*.]

—— **prælonga**, Reuss. Verstein. böhm. Kreide, 1845–46, i, 39, xii, 14. [v. *Spiroplecta*.]

—— —— —— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 679, xxiv, 71.

[**TEXTULARIA**] **rotundata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xv, 6.

——— **rugosa**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, not descr., xv, 7.

——— **rugosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 262, No. 10.

——— **rugosa** (Reuss). Brady, Report Challenger, 1884, 363, xlii, 23, 24. [*Plecanium*, 1869.]

——— **sagittata**, Jones, Parker, & Brady. Crag. Foram., Pal. Soc. XIX, 1866, n. d., iii, 7–9.

——— **sagittula**, Defrance. Dict. Sci. Nat. XXXII, 1824, 177 ; LIII, 1828, 344 ; Atlas, Conch. xiii, 5.

——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 370, v, 6 [error for 5].

——— ——— ——— D'Orbigny, Ann. Sci. Nat. VII, 1826, 263, No. 20.

——— ——— [d'Orb.]. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 138, i, 19–21.

——— ——— [d'Orb.]. Reeve, Conch. system. II, 1842, 292, ccxcvii, 10.

——— ——— [d'Orb.]. Reuss, in Geinitz, Grundr. Verstein. 1845–46, 680, xxiv, 72.

——— ——— ——— Costa, Mem. Acc. Sci. Napoli, II, 1855 (1857), 125, i, 16.

——— ——— [d'Orb.]. Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 291 [287], xxiii, 11*A*, *C*.

——— ——— ——— Parker & Jones, Ann. Mag. Nat. Hist. [2], XIX, 1857, 297, xi, 44 ; 45 var. *aciculata*.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 168, xi, 114.

——— ——— ——— Nicholson, Manual Palaeont. 1879, i, 116, fig. 18*l*.

——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 72, iv [error for v], 133–158.

——— ——— ——— (forma **Bigenerina**), Goës. K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 78, v, 159–161.

——— ——— ——— var. **soldanii**, Fornasini. Boll. Soc. geol. Ital. II, 1883, 183, ii, 2*a*–*d*.

——— ——— ——— Brady, Report Challenger, 1884, 361, xlii, 17 and 18.

——— ——— ——— var. **fistulosa**, Brady. Report Challenger, 1884, 362, xlii, 19–22.

——— ——— ——— Balkwill & Wright, Trans. R. Irish Ac. XXVIII (Sci.), 1885, 332, xiii, 15–17.

——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VI, 1887, 399, xi, 2*a*, *b*.

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——— ——— ——— Malagoli, Boll. Soc. geol. Ital. VI, 1887, 520, xiii, 1.

——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 219, xlii, 1.

——— ——— ——— Fornasini, Boll. Soc. geol. Ital. VII, 1888, 46, iii, 2, 2*a*, 3 and 4.

——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 164, fig. 500.

——— ——— ——— See *Polymorpha sagittulæ*.

——— ——— ——— See *T. agglutinans*, d'O.

——— **saulcyana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 146, i, 21 and 22 ; also in Spanish, 1840, 137, same pl. and fig.

——— **scabra**, Fischer. Actes Soc. Linn. Bordeaux, XXVII, 1870, 393, No. 32. [= *Verneuilina polystropha*.]

——— **scalpelliformis**, Potiez et Michaud. Galerie des Mollusques Mus. Douai, I, 1838, 28, ix, 4–6. [? a *Frondicularia*.]

———* **scyphiphila**, Uhlig. Mojsisovics und Neumayr's Beiträge Pal. Oest.-Ungarn, I, 1882, 180, xv, 2 and 3.

———* **semipunctata**, Ehr. Abhandl. k. preuss. Ak. Wiss. Berlin, 1841, 429, ii, vi, 44. [= *Bolivina ?*]

[TEXTULARIA] **triquetra**, v. Muenster. Goës, K. Svenska Vet.-Akad. Handl. xix, No. 4, 1882, 83, vi, 183 and 184.

——— ——— ——— (forma **Bigenerina**). Goës, K. Svenska Vet.-Akad. Handl. xix, No. 4, 1882, 85, vi, 185 and 186.

———* **triseriata**, Terquem. Mém. Soc. géol. France, [3], ii, 1882, 145, xv (xxiii), 10.

——— **triticum**, Jones. In King, Pal. Soc. 1850, 18, vi, 5.

——— ——— ——— Richter, Zeitschr. deutsch. geol. Ges. vii, 1855, 532, xxvi, 24 and 25.

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——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. xxx, 1876, 134, x, 24 and 25.

——— ——— [King]. Roemer, Lethaea Geognostica, Th. i, Lief. 1, 1880, 271; and Atlas, 1876, lxii, 2.

——— **trochioides**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 263, No. 22.

——— **trochus**, d'Orbigny. Mém. Soc. géol. France, [1], iv, 1840, 45, iv, 25 and 26; facsimile in Science Gossip, 1870, 157, fig. 153.

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——— ——— ——— Eley, Geol. in the Garden, 1859, 199, vi, 34. [Flint cast.]

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——— ——— ——— Vanden Broeck, Ann. Soc. Belge Mikros. ii, 1876, 132, iii, 11 and 12; and Fonds de la Mer, iii (1876).

——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. xix, No. 4, 1882, 80, v, 167–170; vi, 171 and 172.

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——— ——— ——— Agassiz, Three Cruises "Blake," ii, 1888, 165, fig. 501.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], vi, 1889, 110, v, 4.

———* **trochus**? Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.

——— **tuberosa**, d'Orbigny. Ann. Sci. Nat. vii, 1826, 263, No. 26.

——— ——— ——— Fornasini, Boll. Soc. geol. Ital. vi, 1887, 161, ii, 2*a*, *b*.

——— ——— ——— = *T. gibbosa*, d'O.; see *Polymorpha janiformia*.

——— (**Bigenerina**) **tubulifera**, Parker & Jones. Ann. Mag. Nat. Hist. [3], xi, 1863, 92, fig. 2.

——— **turris**, d'Orbigny. Mém. Soc. géol. France, [1], iv, 1840, 46, iv, 27 and 28; facsimile in Science Gossip, 1870, 157, fig. 154.

——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 39; xiii, 76.

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——— ——— ——— Eley, Geol. in the Garden, 1859, 202, viii, 10*C*.

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———* **ulmensis**, Gümbel. Sitz. k.-bayer. Ak. Wiss. i, 1871, 68, i, 17.

———* **undulosa**, Terquem. Mém. Soc. géol. France, [3], iv, 1886, 61, vii, 7*a*, *b*.

———* **uniseriata**, Ehr. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1861, 309.

——— **unita**, Fornasini. Boll. Soc. geol. Ital. vi, 1887, 397, x, 2*a*, *b*.

——— **variabilis**, Williamson. Recent British Foram. 1858, 76, vi, 162–168, "162 and 163 typica."

——— ——— ——— v. **difformis**, Williamson. Recent British Foram. 1858, 77, vi, 166 and 167.

——— ——— ——— v. **lævigata**, d'Orb. Williamson, Recent British Foram. 1858, 77, vi, 168.

THALAMOPORA cribrosa (Goldfuss). Reuss, in Geinitz, Palaeontographica, xx, Th. 1, 1872, 137, xxxiii, 11–15.
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THEMEON rigatus, Montfort. Conch. syst. I, 1808, 203, 51st genre. [= *Polyst. crispa.*]
THOMASINELLA, Schlumberger, 1889. C. R. Soc. géol. France, 18 Mars 1889, xlvii.
THURAMMINA, Brady, 1879. Q. Journ. Micros. Sci. XIX, 1879, 45; Brady, Report Challenger, 1884, 321.
——— **albicans**, Brady. Q. Journ. Micros. Sci. XIX, 1879, 46, no figure.
——— ——— ——— Brady, Report Challenger, 1884, 323, xxxvii, 2–7.
——— **compressa**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 46, v, 9.
——— ——— ——— Brady, Report Challenger, 1884, 324, xxxvii, 1.
——— **hemisphærica**, Haeusler. Neues Jahrbuch, 1883, I, 60, iv, 14 and 14*a*.
——— ——— ——— Haeusler, Quart. Journ. Geol. Soc. XXXIX, 1883, 28, iii, 7–9.
——— **papillata**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 45, v, 4–8. [v. "Orbuline lituola," 1875.]
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——— ——— ——— Haeusler, Neues Jahrbuch, 1883, I, 60, iv, 9–13.
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——— **canaliculata**, Haeusler. Neues Jahrbuch, 1883, II, 69, iv, 1–12.
THYRSOPORELLA. Gümbel, Abh. k.-bayer. Ak. Wiss. München, XI, 1871 (1874), 231, etc., plates. [A genus of calcareous Algæ, v. Solms-Laubach, Einleit. Palaeophytologie, 1887, 38, etc.] [Gümbel's spp. are *T. cancellata*; *T. cribrosa.*]
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——— ——— ——— var. **sphæroidalis**, Carter. Ann. Mag. Nat. Hist. [4], XIX, 1877, xiii, 18, 20, 21, 22. [Referred to *Gypsina globulus*, 1884.]
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——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 758, xvi, 24. [= *Ramulina*, teste De Amicis.]

TRILOCULINA angusta, Deshayes. Ency. Méth. (Vers), III, 1832, 1052.
——— **angusta**, Philippi. Tertiär. nordwest. Deutsch. 1843, 43, i, 40. [v. *Quinqueloculina.*]
——— **angusta**, Terq. Mém. Soc. géol. France, [3], I, 1878, 59, v (x), 28*a*, *b*.
? ——— **antillarum**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429, ii, vi, 39. [= ? *Quinqueloc.*]
——— **austriaca**, d'Orbigny. Foram. Fossiles Vienne, 1846, 275, xvi, 25–27. [v. *Miliola.*]
——— ——— ——— Mackie, Science Gossip, 1867, 131, fig. 133.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 81, xi, 3*a*, *b* ; (and Mém. Soc. Dunkerquoise).
——— **bicarinata**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 180, x, 18–20 ; also in Spanish, 1840, 158, same pl. and fig.
——— **bicornis** (W. & J.). Brown, Illustr. Conch. Gt. Brit. ed. 2, 1844, 2, lvi, 24. [*Serpula*, 1798.]
——— **bipartita**, d'Orbigny. Foram. Fossiles Vienne, 1846, 275, xvii, 1–3.
——— **boliviana**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 69, iv, 7–9.
——— **bornemanni**, Bosquet. Verh. Koninkl. Akad. Wetensch. VII, 1859, 25, ii, 12*a*–*c*.
——— **brongniartiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 176, x, 6–8 ; also in Spanish, 1840, 156, same pl. and fig.
——— ——— ——— Bailey, Smithsonian Contrib. II, 1851, 13, pl. (44, 45) ?. [44 may be *Trochammina.*]
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——— **carinata**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 179, x, 15–17 ; also in Spanish, 1840, 157, same pl. and fig.
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——— ——— ——— See *Frumentaria* 3 *speciei.*
——— **carinata**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 300, iii, 1.
——— **carinata**, Philippi. Tertiär. nordwest. Deutsch. 1843, 43, i, 36.
——— **cassis**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 60, v (x), 30*a*, *b*.
——— **caudata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 2, 1876, 81, xi, 1 ; (and Mém. Soc. Dunkerquoise).
——— **chemnitziana**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 141, iii, 19–21.
——— **circularis**, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 349, xix, 4. [v. also *Miliolina.*]
——— **communis**, Deshayes. Déscript. Coq. Charact. 1831, 252 and 259, iii, 5, 6, and 7. [v. *Miliola* ; *Miliolina.*]
——— ——— ——— Bronn, Lethaea Geognostica, ed. 2, 1837, 1145, xlii, 31*a*, *b*, *c*.
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——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, III, 1853–56, 246, xlii, 31*a*, *b*, *c*.
——— **consobrina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 277, xvii, 10–12. [v. *Miliola.*]
——— **cor-anguinum** (Lam.). Dixon, Geol. etc. Sussex, 1850, 85, ix, 9 ; and 2d ed. 1878, 172. [*Miliolites*, 1804.]
——— **costata**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 327, xxxvi, 1*a*, *b*.
——— **costifera**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 60, v (x), 31*a*, *b*.

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——— ——— ——— Toula, Mitth. geogr. Ges. Wien, XVIII, 1875, 165, pl., 19.
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——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 77, fig. 10^2.
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——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 27, pl., 115.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 190, viii, 3.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 163, xvi (xxiv), 31*a*, *b*, *c*.
——— ——— ——— Hoernes, Elem. Palaeont. 1884, 34, fig. 32 ; French ed. 1886, same fig.
——— ——— ——— See *Frumentaria tricostata*.
——— **gibberula**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 60, v (x), 29*a*, *b*.
——— **glabra** (Brown). Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, lvi, 20, 21. [*Renoidea*, 1827.]
——— ——— ——— G. B. Sowerby, Foram. Colne Tidal River, 1856, [privately printed], plate, fig. 10. [= *M. seminulum.*]
——— **globulus**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 71, ix, 9 and 10.
——— **gracilis**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 181, xi, 10–12 ; also in Spanish, 1840, 159, same pl. and fig. [Given as *Quinqueloculina* in error on plate.] [v. *Miliolina.*]
——— **granulata**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 8, i, 13.
——— **gualtieriana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 170, ix, 5–7 ; also in Spanish, 1840, 152, same pl. and fig.
——— **hartingi**, Bosquet. Verh. Koninkl. Akad. Wetenschappen, VII, 1859, 24, ii, 11*a–c*.
——— **hemisphærica**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 163, xvi (xxiv), 32, 33.
——— **incerta**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 57, v (x), 19*a*, *b*.
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——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. XXII, 1841, 299, iii, 11.
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——— ——— ——— = *Quinqueloc.* ; see *Frumentarium nautiliforme.*
——— **inflata**, Deshayes. In Lyell, Principles of Geology, III, 1833, 251, iv, 1–4.
——— **inornata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 279, xvii, 16–18.
——— **intermedia**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 138, i, 11.
——— **josephina**, d'Orbigny. Cours élém. Paléont. I, 1849, 204, fig. 331 ; II, fas. 2, 1852, 818, fig. 626.
——— **kochi**, Nemes. Orvos term. értesitö (term. szak), XIII, 1888, 162 and 217, vi, 1.

TRILOCULINA oblonga (Montagu). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 251, viii, 8. [*Quinqueloc. longirostris*, d'O., q. v.]
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——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 168, xvii (xxv), 20 and 21.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 163, fig.
——— **obotritica**, Boll. Geogn. deutsch. Ostseeländer, 1846, 177, ii, 14.
——— **oculina**, d'Orbigny. Foram. Fossiles Vienne, 1846, 277, xvii, 7–9.
——— **orbicularis**, Roemer. Neues Jahrbuch, 1838, 393, iii, 74.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XVIII, 1856, 251, viii, 85.
——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 220, x, 24.
——— **ovalis**, Roemer. Neues Jahrbuch, 1838, 393, iii, 73.
——— **oviformis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 165, xvii (xxv), 2*a*, *b*.
——— **oxfordiana**, Deecke. Mém. Soc. Emul. Montbéliard, XVI, 1886, [18], i, 32, 32*a*.
——— **perforata** [W. & J.]. Brown, Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, lvi, 26. [*Serpula*, 1798.]
——— **planciana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 173, ix, 17–19; also in Spanish, 1840, 154, same pl. and fig.
——— **plicata**, Terquem. Mém. Soc. géol. France, [3], I, 1878, 61, vi (xi), 2*a*, *b*.
——— **porvaensis**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 76, xiii, 3; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 21, same pl. and fig.
——— **propinqua**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 168, xvii (xxv), 19*a*–*e*.
——— **pulchella**, d'Orbigny. Foram. Fossiles Vienne, 1846, 279, xvii, 19–21.
——— ——— ——— Mackie, Recreative Science, I, 1859, 149, fig. 32.
——— **pyrula**, Karrer. Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 359, ii, 7.
——— **quadrilateralis**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 173, ix, 14–16; also in Spanish, 1840, 153, same pl. and fig. [*T. quadrilatera* on plate.]
——— **raibliana**, Gümbel. Jahrb. k. k. geol. Reichsanstalt, XIX, 1869, 182, vi, 34.
——— **reticulata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 299, No. 9. [v. *Miliolina* and *Quinqueloculina*.]
——— ——— ——— = *Quinqueloc.*; see *Frumentaria reticulata*.
——— **retortioris**, Nemes. Orvos term. értesitö (term. szak), XIII, 1888, 163 and 218, vi, 2. [= *Vertebralina*.]
——— **rosea**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 69, iii, 18–20.
——— **rostrata**, Michelotti. Mem. Soc. Ital. Sci. XXII, 1841, 300, iii, 3.
——— ——— ——— Michelotti, Nat. Verh. Holland. Maatsch. Wetensch. Haarlem, [2], III, (2), 1847, 18, not fig'd.
——— **rotunda**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 299, No. 4.
——— **rotundata**, Brown. Illustr. Recent Conch. Gt. Brit. ed. 2, 1844, 2, lvi, 14 and 15. [*Renoidea*, 1827.]
——— **rugosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 299, No. 8.
——— **scapha**, d'Orbigny. Foram. Fossiles Vienne, 1846, 276, xvii, 4–6.
——— **schreiberiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 174, ix, 20–22; also in Spanish, 1840, 154, same pl. and fig. [*T. schrebeiriana* on plate.]
——— **selene**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 138, i, 12.

TRILOCULINA trigonula [d'Orb.]. Roemer, Neues Jahrbuch, 1838, 393, iii, 71.
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——— **triquetra**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 164, xvi (xxiv), 36 and 37.
——— **truncata**, Karrer. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 704, i, 2.
——— **tumida**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 169, xvii (xxv), 24*a*, *b*, *c*.
? ——— ? **turgida**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1841, 429, ii, vi, 40.
——— **turgida**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 86, vii, 58.
——— ——— ——— Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 220, x, 29.
——— ——— ——— var. **inflata**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 220, x, 28.
——— **unidentata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 299, No. 5.
——— **valvularis**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 85, vii, 56. [v. *Miliolina.*]
——— **variabilis**, Terquem. Quatr. Mém. Foram. Oolithique, 1874, 328, xxxv, 12–22.
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——— Pilla, Trattato Geol. Pt. I, 1847, 462, fig. 84; and Pt. II, 1851, 249, fig. 162.

TROCHAMMINA constricta, Haeusler. Ann. Mag. Nat. Hist. [5], x, 1882, 57, iv, 23–26.
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——— **coronata**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 58, v, 15.
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——— **crassa**, Gümbel. Anleit. geol. Beob. Alpenreisen Zeitschr. D. & O. Alpenver., Beilage, 1878, 105, fig. 25^{21}.
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——— **discoidea**, Karrer. In v. Drasche, Fragment Geol. Luzon, 1878, 84, v, 1; and Boll. Com. Map. Geol. Españ. VII, 1880, 266*E*, 1.
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——— **gordialis**, Jones & Parker. Carpenter, Parker, & Jones, Introd. Foram. 1862, 141, xi, 4. [v. *Ammodiscus* and *T. squamata gordialis*.]
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——— **incerta** (d'Orbigny). Carpenter, Parker, & Jones, Introd. Foram. 1862, 141, xi, 2. [*Operculina*, 1839.]
——— ——— ——— J., P., & K., Ann. Mag. Nat. Hist. [4], IV, 1869, 389, xiii, 1.
——— ——— ——— Brady, Carbonif. Foram., Pal. Soc. XXX, 1876, 71, ii, 10–14.
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——— ——— ——— v. **gracilis**, Haeusler. Ann. Mag. Nat. Hist. [5], x, 1882, 356, xv, 3. [v. *Cornuspira*.]
——— ——— ——— v. **granulosa**, Haeusler. Ann. Mag. Nat. Hist. [5], x, 1882, 356, xv, 1.
——— ——— ——— v. **megaspira**, Haeusler. Ann. Mag. Nat. Hist. [5], x, 1882, 356, xv, 4.
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——— **(Ammod.)** ——— ——— Haeusler, Neues Jahrbuch, 1883, i, 59, iv, 1.
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—— —— —— Brady, Report Challenger, 1884, 338, xli, 4*a–c*. [See *Nautilus*.]
—— —— —— var. Haeusler, Neues Jahrbuch, Beil. Bd. IV, Heft 1, 1885, 28, iii, 28.
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—— —— **alternans**, Jones & Parker. Quart. Journ. Geol. Soc. XVI, 1860, 304.
—— —— **clavata**, Jones & Parker. Idem.
—— —— —— Carpenter, Parker, & Jones, Introd. Foram. 1862, 142, xi, 6–10. [6 = *T. clavata* (var. of *irregularis*); 7 = intermediate var.; 8 = chalk form; 9 = typica; 10 = *alternans*.]
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—— **(Ammod.)** —— —— Haeusler, Neues Jahrbuch, 1883, i, 59, iv, 4.
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—— —— —— Brady, Report Challenger, 1884, 342, xl, 4–7.
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—— **proteus**, Karrer. Sitz. k. Ak. Wiss. Wien, LII, Abth. 1, 1865 (1866), 494, pl., 1–8.
—— —— —— Zittel, Handbuch Palaeont. Abth. I, 1876, 76, fig. 8[6].
—— —— —— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 78.
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——— **robertsoni**, Brady. Journ. R. Micr. Soc. 1887, 893.
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——— **ringens**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 57, v, 12*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 343, xl, 17 and 18.
——— **roessleri** (Schmid). See *Serpula*, 1867.
——— **shoneana**, Siddall. Proc. Chester Soc. Nat. Sci. No. 2, 1878, 46, figures 1 and 2.
——— **squamata**, Jones & Parker. Quart. Journ. Geol. Soc. XVI, 1860, 304.
——— ——— **charoides**, Jones & Parker. Idem. ; v. also *T. charoides*.
——— ——— **gordialis**, Jones & Parker. Idem. ; v. also *T. gordialis*.
——— ——— **incerta**, Jones & Parker. Idem. ; v. also *T. incerta*.
——— ——— **inflata**, Jones & Parker. Idem. ; and Ann. Mag. Nat. Hist. [3], IV, 1859, 347 ; v. also *T. inflata*.
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——— ——— ——— v. **gordialis**, P. & J. Phil. Trans. 1865, 408, xv, 32.
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——— ——— ——— Haeusler, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 29, iii, 30.
[TROCHAMINA] tolypa, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 21, i, 6–6*b*.
——— **trullissata**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 56, v, 10*a*, *b*, and 11.
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——— sp. ind. Haeusler, Ann. Mag. Nat. Hist. [5], x, 1882, 357, xv, 17, 18, and 19. (17 and 18 resemble *T.* (*Amm.*) *filum*, Schm. ; 19 = ?).
——— sp. ind. Haeusler, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 29, iii, 29.
——— Haeusler, Neues Jahrbuch, Beil. IV, Heft 1, 1885, 29, iii, 32.
——— Bornemann, Jahrb. k. pr. geol. Landesanstalt, 1885 (1886), 292, xiii, 1*b*.
TROCHILISCUS, Pander. See *Miliola panderi*, Ehrenberg.
TROCHULINA,* d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 274.
——— **complanata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 37. [v. *Rotalina*.]
——— **ferussaci**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 38.
——— **turbo**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 274, No. 39.
TRUNCATULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 279 ; Brady, Report Challenger, 1884, 658.
——— **advena**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 87, vi, 3–5 ; also in Spanish, 1840, 97, same pl. and fig.
——— **agglomerata**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 125, xvi, 3 ; (and Mém. Soc. Dunkerquoise).
——— **akneriana** (d'O.). Brady, Report Challenger, 1884, 663, xciv, 8*a*, *b*, *c*. [*Rotalina*, 1846.]
——— ——— ——— Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 44, vi, 1 and 2.
——— **alternans**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 250, xx, 12*A*, *B*, *C*. [*lobatula* in expl. to plate.]
——— **amphisyliensis**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 255, x, 30.

* Given as a subgenus of *Rotalia*.

TRUNCATULINA disjuncta, Terq. Mém. Soc. géol. France, [3], II, 1882, 95, x (xviii), *3a–c*.

——— **dispars**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 38, v, 25–27.

——— **dutemplei** (d'O.). Reuss, Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 160, iv, 16. [*Rotalina*, 1846.]

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 61, viii, 5; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 71, same pl. and fig.

——— ——— ——— Brady, Report Challenger, 1884, 665, xcv, *5a, b, c*.

——— ——— ——— Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 48, vii, *2a–c*.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 118, viii, 10, 11.

——— **echinata**, Brady. Report Challenger, 1884, 670, xcvi, 9–14. [*Planorbulina*, 1879.]

——— ——— ——— v. **lævigata**, Howchin. Trans. R. Soc. S. Austral. XII, 1889, 13, i, 8.

——— **elegantissima**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 91, ix, *7a, b*.

——— **elongata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 279, No. 2.

——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 3, 1881, 126, xvi, *6a, b*; (and Mém. Soc. Dunkerquoise).

——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 93, ix (xvii), *26a, b*.

——— **evoluta**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 65, x, 1; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 75, same pl. and fig. [*T. lobata*, in descr. of plate.]

——— **falcata**, Reuss. Sitz. k. Ak. Wiss. Wien, LIX, Abth. 1, 1869, 461, ii, *1a–c*.

——— **flos**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 182, iv, 15.

——— **formosa**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 149, xiv, *6a, b* [error for 5].

——— **globulosa**, Terquem. Bull. Soc. zool. Fr. XI, 1886, 333, xi, 12 and 13.

——— **granosa**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 65, x, 2; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 74, same pl. and fig.

——— **grosserugosa**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 660, ii, *104a, b*. [v. *Anomalina*.]

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 64, ix, 6; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 74, same pl. and fig.

——— ——— ——— Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 175, ii, 16–21; and 176, fig. 4.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 117, viii, 5.

——— **haidingeri** (d'O.). Brady, Report Challenger, 1884, 663, xcv, *7a, b, c*. [*Rotalina*, 1846.]

——— ——— ——— Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 50, viii, *3a–c*.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 118, viii, 7–9.

——— **horrida**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 183, ii, 14.

——— **humilis**, Brady. Report Challenger, 1884, 665, xciv, *7a, b, c*.

——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 117, vii, 11.

——— n. sp. aff. **humilis**, Brady. Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 181, iii, 2.

——— **inæqualis**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 182, iv, 14.

——— **infractuosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 279, No. 3.

TRUNCATULINA lobatula [d'Orb.]. Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 49.
——— ——— [d'Orb.]. Marsson, Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, Jahrg. x, 1878, 167, v, 38*a–g*.
——— ——— ——— Vine, Science Gossip, 1878, 52, figs. 39 and 40.
——— ———? [d'Orb.]. Hopkins, Execut. Doc., 45 Congress, Sess. 3, IV, Report Chief Engineers, pt. 2, App. W, 1878–79, 885, i, 65.
——— ——— ——— Nicholson, Manual Palaeont. 1879, i, 117, fig. 18*p*.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXIII, 1880, 205, iii, 57.
——— ——— [d'Orb.]. Terquem, Ess. Anim. Plage Dunkerque, pt. 3, 1881, 126, xvi, 4*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— v. **umbilicata**, d'Orb. Terquem, Ess. Anim. Plage Dunkerque, pt. 3, 1881, 126, xvi, 5*a*, *b*, *c*; (and Mém. Soc. Dunkerquoise).
——— ——— [d'Orb.]. Terq., Mém. Soc. géol. France, [3], II, 1882, 94, ix (xvii), 27*a*, *b*.
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 784, xxiv, 9*a*, *b*.
——— ——— ——— Brady, Report Challenger, 1884, 660, xcii, 10; xciii, 1, 4, and 5; cxv, 4 and 5.
——— ——— ——— Gümbel, Geol. Bayern, Th. I, Lief. 2, 1885, fig. 266^{22}.
——— ——— ——— Dawson, Handbook Zoology, ed. 3, 1886, 46, fig. 39.
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 756, xvi, 12*a–c*.
——— ——— ——— Malagoli, Atti Soc. Nat. Modena (Rend.), 3, iii, 1887, 110, i, 14.
——— ——— [d'Orb.]. Toutkowski, Zap. Kievsk. Obshch. Est. IX, 1888, 46, vii, 1*a–c*.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 227, xlii, 20; xlv, 26.
——— ——— ——— Steinmann, Elém. Paléont. I, 1888, 29, fig. 11.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 116, vii, 5–7.
——— ——— ——— Soldani, Testac. I, 1, 1789, 58, pl. 41 (? all), pl. 42 (all but *N*), pl. 43, pl. 44 (? all), pl. 45 = this form.
——— ——— ——— See *Planorb. farcta* (F. & M.).
——— **lucida**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865, 160, iv, 15.
——— **magnifica**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, n. d., xiv, 3.
——— **margaritifera**, Brady. Quart. Journ. Micr. Sci. XXI, 1881, 66.
——— ——— ——— Brady, Report Challenger, 1884, 667, xcvi, 2*a*, *b*, *c*.
——— **marginata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 64, vii, 10.
——— **miquelonensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 279, No. 7.
——— **mundula**, Brady, Parker, & Jones. Trans. Zool. Soc. XII, pt. 7, 1888, 228, xlv, 25.
——— **nucleata**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 64, vii, 8.
——— ——— ——— Hantken, Ertek. Termesz. köreböl, XIII, No. 1, 1883, 30, iii, 3*a*, *b*, *c*; and Math. Nat. Ber. Ungarn, II, 1884, 150.
——— **oblongata**, Reuss. Bull. Ac. Roy. Belg. [2], XV, 1863, 155, iii, 45.
——— **orbicularis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 95, x (xviii), 4 and 5.
——— **ornata**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 40, vi, 7–9.
——— **osnabrugensis**, v. Muenst. Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 63, ix, 4; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 73, same pl. & fig. [*Planulina*, 1838.]
——— **pachyderma**, Rzehak. Verh. nat. Ver. Brünn, XXIV, 1885 (1886), 87, i, 5.
——— **papillata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 183, v, 2.
——— **præcincta** (Karr.). Brady, Report Challenger, 1884, 667, xcv, 1–3. [*Rotalia*, 1868.]

TRUNCATULINA stella, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 182, iv, 13.
——— **sublævis**, v. Hagenow. Neues Jahrb. 1842, 571.
——— **sublobatula**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 659, ii, 103*a*, *b*, *c*.
——— ——— ——— Uhlig, Jahrb. k. k. geol. Reichsanstalt, XXXVI, 1886, 180, ii, 22.
——— **tenella**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 477, v, 6*a–c*.
——— **tenera**, Brady. Report Challenger, 1884, 665, xcv, 11*a*, *b*, *c*.
——— **tenuimargo**, Brady. Report Challenger, 1884, 662, xciii, 2 and 3.
——— **tenuissima**, Reuss. Sitz. k. Ak. Wiss. Wien, XLIV, Abth. 1, 1861 (1862), 317, iii, 2*a–c*.
——— **trochoidea**, Karrer. In von Drasche, Frag. Geol. Luzon, 1878, 97, v, 25; and Bol. Com. Map. geol. Españ. VII, 1880, 281*F*, 11.
——— **tuberosa** (F. & M.). P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 177, xii, 138. [See *T. variabilis*, d'O.] [*Nautilus*, 1798.]
——— **tuberculata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 279, No. 1.
——— ——— ——— d'Orbigny, Modèles, 1826, No. 37.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 37], Ann. Mag. Nat. Hist. [3], XVI, 1865, 25, ii, 77. [= *T. lobatula*, W. & J.]
——— ——— [Sold.]. Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— ——— ——— = *T. lobatula* (W. & J.); see *Hammoniæ tuberculatæ*.
——— **tumescens**, Egger. Neues Jahrbuch, 1857, 279, ix, 14–16.
——— **tumidula**, Brady. Report Challenger, 1884, 666, xcv, 8*a*, *b*, *c*.
——— **ungeriana**, d'Orb. Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 62, viii, 7; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 72, same pl. and fig. [*Rotalina*, 1846.]
——— ——— ——— Brady, Report Challenger, 1884, 664, xciv, 9*a*, *b*, *c*, *d*.
——— [**ungherana**, d'O.]. Hantken, Ertek. Termesz. köreböl, XIII, No. 1, 1883, 12; and Math. Nat. Ber. Ungarn, II, 1884, 133.
——— ——— ——— Agassiz, Three Cruises "Blake," II, 1888, 169, fig. 518.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 117, viii, 4.
——— **variabilis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 279, No. 8.
——— ——— ——— Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 135, ii, 29.
——— ——— ——— Reuss, Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 10, i, 15.
——— ——— ——— Mackie, Science Gossip, 1867, 131, fig. 139.
——— ——— ——— Terquem, Ess. Anim. Plage Dunkerque, pt. 2, 1876, 75, ix, 3*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terq., Mém. Soc. géol. France, [3], I, 1878, 20, i (vi), 18*a*–25.
——— ——— ——— v. **obscura**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 127, xvi, 7*a*, *b*; (and Mém. Soc. Dunkerquoise).
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 92, ix (xvii), 22–25.
——— ——— ——— Brady, Report Challenger, 1884, 661, xciii, 6 and 7.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 227, xlv, 17.
——— ——— ——— Terrigi, Mem. R. Acc. Lincei, [4], VI, 1889, 116, vii, 8, 9.
——— ——— ——— = *T. tuberosa* (F. & M.); see *Testæ hammoniformes*.
——— **varians**, Reuss. Sitz. k. Ak. Wiss. Wien, XLII, 1860 (1861), 359, ii, 12*a–c*.
——— **vermiculata**, d'Orbigny. Voyage Amér. Mérid. 1839, v, pt. 5, "Foraminifères," 39, vi, 1–3.
——— **vortex**, Seguenza. Atti R. Acc. Lincei, [3], VI, 1880, 91, ix, 8*a*, *b*.
——— **weinkauffi** (Rss.). Andreae, Abh. geol. Specialkarte, Elsass-Lothr. II, Heft 3, 1884, 218, viii, 11. [*Rosalina*, 1863.]

UNILOCULINA indica, d'Orbigny. Foram. Fossiles Vienne, 1846, 261, xxi, 53 and 54.
——— ——— ——— Reuss' Models, No. 82, 1865 (Catal., No. 16, 1861). [= ? young of a striped *Quinqueloc.*]
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 791, xxiii, 2.
——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1060, lxxxvii, 7.
——— **orbignyi**, Terquem. Ess. Anim. Plage Dunkerque, pt. 3, 1881, 132, xvii, *8a, b*; (and Mém. Soc. Dunkerquoise).
——— Parker, Trans. Micr. Soc. London, n. s. VI, 1858, 54, fig.
URNULINA, Gruber, 1884. Nova Acta k. Leop.-Carol. Deutsch. Ak. Nat. XLVI, 1884, 496.
——— **difflugiæformis**, Gruber. Nova Acta k. Leop.-Carol. Deutsch. Ak. Nat. XLVI, 1884, 496, viii, 18.
UTERIA, Michelin, 1845. Iconogr. Zoophyt. 1840–47, 177; see Gümbel, Abh. k.-bayer. Ak. Wiss. München, XI, 1871 (1874), 231, etc. plates. [A genus of calcareous algæ; v. Solms-Laubach, Einleit. Palaeophytologie, 1887, 38, etc.
UVELLINA, Ehrenberg, 1838. Abh. k. Ak. Wiss. Berlin, 1838 (1840), Tab. 1. [A family group name.]
UVIGERINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 268; Brady, Report Challenger, 1884, 573.
——— **abbreviata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 120, xii (xx), 33.
——— **aculeata**, d'Orbigny. Foram. Fossiles Vienne, 1846, 191, xi, 27 and 28.
——— ——— ——— Brady, Report Challenger, 1884, 578, lxxv, 1–3.
——— **angulosa**, Williamson. Recent British Foram. 1858, 67, v, 140.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 200, vii, 31.
——— ——— ——— Brady, Report Challenger, 1884, 576, lxxiv, 15–18.
——— ——— ——— v. **spinipes**, Brady. Report Challenger, 1884, 577, lxxiv, 19 and 20. [*U. spinipes*, 1881.]
——— ——— ——— See *U. pygmæa*, d'O.
——— **asperula**, Czjzek. Haidinger's Naturw. Abh. II, 1848, 146, xiii, 14 and 15.
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, LV, Abth. 1, 1867, 93, iv, *6a, b*, 7, 8, and 9.
——— ——— ——— Terrigi, Atti Acc. Pont. Nuovi Lincei, XXXV, 1883, 185, ii, 26.
——— ——— ——— Brady, Report Challenger, 1884, 578, lxxv, 6–8.
——— ——— ——— v. **ampullacea**, Brady. Report Challenger, 1884, 579, lxxv, 10 and 11.
——— ——— ——— v. **auberiana**, d'O. Brady, Report Challenger, 1884, 579, lxxv, 9. [*U. auberiana*, 1839.]
——— ——— ——— Sherborn & Chapman, Journ. R. Micr. Soc. [2], VI, 1886, 755, xvi, 7.
——— ——— ——— Anon., Sci. News, 4 May, 1888, 413, fig. 15.
——— ——— ——— Brady, Parker, & Jones, Trans. Zool. Soc. XII, pt. 7, 1888, 225, xlv, 4 and 5.
——— ——— ——— Toutkowsky, Zap. Kievsk. Obshch. Est. IX, 1888, 41, ii, *3a, b, c*.
——— **auberiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 106, ii, 23 and 24; also in Spanish, 1840, 110, same pl. and fig. [v. also *U. asperula*, var.]
——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 60, iv, 71–75.
——— **baccalis**, Schwager. Boll. R. Com. geol. Ital. IX, 1878, 523, i, 9.
——— **bifurcata**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 53, vii, 17.

UVIGERINA bononiensis, Fornasini. Boll. Soc. geol. Ital. VII, 1888, 48, iii, 12, 12*a*.
? —— **borealis**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1841, 429.
? —— —— —— Ehr., Mikrogeologie, 1854, xxxv, *A*, xx, 9. [= ? ; may be *Truncatulina*.]
—— **brunnensis**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 385, xvi, *b*, 49.
—— —— —— Brady, Report Challenger, 1884, 577, lxxv, 4 and 5.
—— **canariensis**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 138, i, 25–27.
—— —— —— Brady, Report Challenger, 1884, 573, lxxiv, 1–3.
—— —— —— Woodward & Thomas, 13 Ann. Rep. Geol. N. H. Survey Minnesota, for 1884 (1885), 171, iv, 37.
—— **cochlearis**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 385, xvi, *b*, 48.
—— **crassicostata**, Schwager. Novara-Exped., Geol. Theil II, 1866, 248, vii, 94.
—— **cribrosa**, Ehrenberg. Bericht. k. preuss. Ak. Wiss. Berlin, 1845, 377.
—— **cristata**, Marsson. Mitth. Nat. Ver. Neu-Vorpommern u. Rügen, Jahrg. x, 1878, 150, iii, 20*a*, *b*, *c*.
—— **decora**, Ehr. Bericht. k. preuss. Ak. Wiss. Berlin, 1845, 377.
—— **(Sagrina) dimorpha**, Park. & Jones. Phil. Trans. 1865, 364, xviii, 18. [v. also *Sagrina*.]
—— —— —— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 62, iv, 77–81.
—— **eocæna**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 645, ii, 78.
—— **farinosa**, Hantken. A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 53, vii, 6 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 62, same pl. and fig.
—— **fragilis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 120, xii (xx), 30.
—— **gemmæformis**, Schwager. Novara-Exped., Geol. Theil II, 1866, 247, vii, 92.
—— **globosa**, Karrer. In von Drasche, Frag. Geol. Luzon, 1878, 94, v, 20 ; and Bol. Com. Map. geol. Españ. VII, 1880, 277*F*, 6.
—— **gracilis**, Reuss. Zeitschr. deutsch. geol. Ges. III, 1851, 77, v, 39.
—— **hispida**, Schwager. Novara-Exped., Geol. Theil II, 1866, 249, vii, 95.
—— **interrupta**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 274, viii, 17 and 18.
—— —— —— Brady, Report Challenger, 1884, 580, lxxv, 12–14.
—— **irregularis**, Brady. Nat. Hist. Trans. Northumb. I, 1865–67 (1867), 100, xii, 5.
—— —— —— Soldani, Testac. II, 1798, 18, pl. 4*H*, resembles this form ; see P., J., & B., Ann. Mag. 1871, 171.
—— **lævis**, Ehrenberg. Bericht k. preuss. Ak. Wiss. Berlin, 1845, 377.
—— **(Heterostomella) lævis**, P. & J. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 61, iv, 76. [v. *Heterost. aculeata, lævis*, P. & J., 1872.]
—— **multistriata**, Hantken. A magy. kir. földt. int. évkönyve, I, 1871, 129, ii, 14 ; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, I, 1871, 135, same pl. and fig.
—— —— —— Hantken, Kohlenflötze, etc. ungar. Krone, 1878 (transl. from Magyar), 217, fig. 30.
—— **muralis**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 119, xii (xx), 26–29.
—— **nitidula**, Schwager. Novara-Exped., Geol. Theil II, 1866, 248, vii, 93.
—— **nodosa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 269, No. 3. [v. *Sagrina*.]
—— **(Sagrina)** —— —— Parker & Jones, Phil. Trans. 1865, 363, xviii, 15.
—— —— —— = *U. pygmæa*, d'O. ; see *Polymorpha pineiformia*.

UVIGERINA nodosa, var. β, d'Orbigny. = *U. pygmæa*, d'O.; see *Testæ pineiformes*, etc.

——— **nuda**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 120, xii (xx), 31.

——— **orbignyana**, Czjzek. Haidinger's Naturw. Abh II, 1848, 147, xiii, 16 and 17.

——— **parkeri**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 385, xvi, *b*, 50.

——— **paucicosta**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 268, xxii, 7*A*.

——— **pigmea**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 269, No. 2. [Error for *pygmæa*.]

——— **plicata**, Ehr. Bericht k. preuss. Ak. Wiss. Berlin, 1854, 249.

——— **porrecta**, Brady. Q. Journ. Micr. Sci. XIX, 1879, 274, viii, 15 and 16.

——— ——— ——— Brady, Report Challenger, 1884, 577, lxxiv, 21–23.

——— **proboscidea**, Schwager. Novara-Exped., Geol. Theil II, 1866, 250, vii, 96.

——— **pygmæa**, d'Orb. Ann. Sci. Nat. VII, 1826, 269, xii, 8 and 9.

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——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. x), 34, xv, 4.

——— ——— ——— Smedley, Ency. Metrop. 1845, undescr., pl. "Mollusca" ?, 28.

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 672, xxiv, 62.

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 190, xi, 25 and 26. [*U. pygmea* on plate.]

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[——— ——— ———] Macdonald, Ann. Mag. Nat. Hist. [2], XX, 1857, 193, v, 6.

[——— ——— ———] Macdonald, Ann. Mag. Nat. Hist. [2], XX, 1857, 193, vi, 21. [Aculeate.]

——— ——— ——— Parker & Jones, Ann. Mag. Nat. Hist. [2], XIX, 1857, 297, xi, 41–43.

——— ——— ——— Williamson, Recent British Foram. 1858, 66, v, 138, 139.

——— **[pygmea]** ——— Mackie, Recreative Science, I, 1859, 148, fig. 25.

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——— ——— ——— Reuss' Models, No. 93, 1865 (Catal., No. 66, 1861).

——— ——— ——— Parker & Jones, Phil. Trans. 1865, 363, xvii, 65*a*, *b*; xiii, 53–57.

——— ——— ——— var. **angulosa**, Will. Parker & Jones, Phil. Trans. 1865, 364, xiii, 58; xvii, 66*a*, *b*.

——— ——— ——— Mackie, Science Gossip, 1867, 131, fig. 138.

——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 171, xi, 109.

——— ——— ——— Idem, 171, xi, 110. [See *U. nodosa*, d'O.]

——— ——— ——— Idem, 171, xi, 111. [See *U. nodosa*, var. β.]

——— ——— ——— Hantken, A magy. kir. földt. int. évkönyve, IV, 1875 (1876), 52, vii, 4; and Mitth. a. d. Jahrb. k. ungar. geol. Anstalt, IV, 1875 (1881), 62, same pl. and fig.

——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 86, fig. 23⁵.

——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 25, pl., 34.

——— ——— ——— Vine, Science Gossip, 1878, 52, fig. 34.

——— ——— ——— var. Brady, Ann. Mag. Nat. Hist. [5], I, 1878, 435, xx, 7*a*, *b*.

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——— ——— ——— Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 59, iv, 68–70.

VAGINULINA acuta, Ehr. Mikrogeologie, 1854, xxix, 40.
——— **alsatica**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 33, i, 21*a*, *b*.
——— **angustissima**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 45, iii, 3.
——— **anomala**, Tate & Blake. Yorkshire Lias, 1876, 464, xvii, 23 and 23*a*.
——— **arguta**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 202, viii, 4. [v. *Planularia*.]
——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 47, iii, 13.
——— ——— ——— Berthelin, Mém. Soc. géol. France, [3], I, 1880, 42, ii (xxv), 7*a*–8*b*.
——— **badenensis**, d'Orbigny. Foram. Fossiles Vienne, 1846, 65, iii, 6–8.
——— ——— ——— Neugeboren, Denkschr. k. Ak. Wiss. Wien, XII (2), 1856, 98, v, 7*a*, *b*, 8 and 9.
——— ——— ——— Costa, Atti Accad. Pontaniana, VII, fas. 2, 1856, 181, xii, 16*a*, *A*.
——— [**badensis**] ——— Reuss' Models, No. 56, 1865 (Catal., No. 42, 1861).
——— ——— ——— Jones, in Microgr. Dict. ed. 4, 1883, 799, xxiii, 35*a*, *b*.
——— **bargensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 40, iv, Rheinfallschicht, 1.
——— **bicostrilata**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 202, viii, 5.
——— **biochei**, Berthelin. Mém. Soc. géol. France, [3], I, 1880, 42, ii (xxv), 9*a*, *b*.
——— **biplicata**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 395, viii, 3*a*, *b*.
——— **birmenstorfensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 25, iii, 14.
——— **brukenthali**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII (2), 1856, 98, v, 10*a*–*d*.
——— ——— ——— Brady, Report Challenger, 1884, 532, lxvi, 18 and 19.
——— **bullosa**, Ehrenberg. Mikrogeologie, 1854, xxiv, 9. [= *V. leguminiformis*, Batsch.]
——— **calcipara**, Ehr. Mikrogeologie, 1854, xxxii, ii, 7. [= *V. leguminiformis*, Batsch.]
——— **caudata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 258, No. 8.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 163, ix, 60.
——— ——— ——— See *Orthoceratia vaginula*.
——— **citharina**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 185, No. 750.
——— **clava**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 6, i, Turnerithon, 8.
——— **clavata**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 145, ii, 18*A*, *B*. [v. *Nodosaria*.]
——— **clavula**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 16.
——— **comitina**, Berthelin. Mém. Soc. géol. France, [3], II, 1880, 38, i (xxiv), 21*a*–*d*.
——— **communis**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), not descr., ii, 3.
——— **cordiformis**, Terq., var. **alsatica**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 35, ii, 8, 8*a*.
——— **cornu**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 25, iii, 13.
——— **correcta**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 18.
——— **costata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 258, No. 6.
——— **costata**, Neugeboren. Denkschr. k. Ak. Wiss. Wien, XII (2), 1856, 98, v, 11.
——— **costulata**, Roemer. Neues Jahrbuch, 1842, 273, vii, *B*, 3. [v. also *Citharina*.]

VAGINULINA costulata, Roemer. Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 90, xxix^1, 22*a–d*.

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——— ——— ——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1051, lxxxvi, 15.

——— **cretæ**, Ehrenberg. Mikrogeologie, 1854, xxiv, 8. [= *V. lævigata*, Roem.]

——— ——— ——— Ehr., Mikrogeologie, 1854, xxxii, ii, 8. [= *V. leguminiformis*, Batsch.]

——— ——— (**brachyarthra**) ——— Ehr., Mikrogeologie, 1854, xxviii, 5. [= *V. longa*, Cornuel.]

——— **cristellarioides**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 48, iii, 17*a*, *b*.

——— [**cristellaroides**] ——— Reuss' Models, No. 87, 1865 (Catal., No. 44, 1861).

——— **denudata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 45, iii, 4*a*, *b*.

——— **depressa**, d'Orbigny. Prodrome de Paléont. I, 1849, 324. [*Planularia*, 1826.]

——— **discors**, Koch. Palaeontographica, I, 1851, 172, xxiv, 1 and 2.

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 50, iii, 10–12*a*, *b*.

——— **dubia**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 20. [= near *Planularia pauperata*.]

——— **dunkeri**, Koch. Palaeontographica, I, 1851, 172, xxiv, 3.

——— ——— ——— Jones & Parker, Quart. Journ. Geol. Soc. XVI, 1860, xx, 36.

——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 1.

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——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.

——— ——— ——— See *V. legumen*, Linn.

——— **elongata**, d'Orb. Prodrome de Paléont. I, 1849, 324. [*Planularia*, 1826.]

? ——— **elongata**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 96, xv, 14.

——— **eocæna**, Gümbel. Abh. m.-ph. Cl. k.-bayer, Ak. Wiss. X, 1868 (1870), 632, i, 49*a*, *b*.

——— **eurynota**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862, (1863), 90, xii, 9*a*, *b*.

——— cf. **flabelloides**, Terq. Deecke, Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 29, i, 16. [*Marginulina*, 1868.]

——— **gaultina**, Berthelin. Mém. Soc. géol. France, [3], I, 1880, 39, i (xxiv), 22*a*–24.

——— **geinitzi**, Reuss. In Geinitz, Palaeontographica, XX, Th. 2, 1874, 91, xxi, 1.

——— **harpa**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 96, xv, 13.

——— ——— ——— Reuss, Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 51, iv, 5*a*, *b*, 6*a*, *b*, and 7.

——— **hausmanni**, Bornemann. Lias von Göttingen, 1854, 38, iii, 25*a*, *b*.

——— **hoffmanni**, Ehr. Mikrogeologie, 1854, xxvi, 7. [= *V. lævigata*, Roem.]

——— **hoplites**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 17.

VAGINULINA humphresiana, Deecke. Abh. geol. Specialkarte, Elsass-Lothr. iv, Heft 1, 1884, 34, i, 19 and 19*a*.

——— **incompta**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, Abth. 1, 1862 (1863), 45, iii, 5*a*, *b*.

——— **incrassata**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, Abth. 1, 1862 (1863), 52, iv, 9*a*, *b*.

——— **integra**, Kübler & Zwingli. Neujahrsblatt Bürgersbibl. Winterthur, 1866, 8, i, 2.

——— ——— ——— Zwingli & Kübler, Foraminif. schweiz. Jura, 1870, 5, i, Turnerithon, 5.

——— **intumescens**, Reuss. Sitz. k. Ak. Wiss. Wien, xlvi, Abth. 1, 1862 (1863), 49, iv, 2.

——— **irregularis**, Ehrenberg. Monatsbericht k. preuss. Ak. Wiss. Berlin, 1858, 30.

——— **italica**, Costa. Mem. Acc. Sci. Napoli, ii, 1855 (1857), 143, ii, 15*A*–*C*.

——— **jurensis**, Gümbel. Jahresh. Ver. vat. Nat. Württ. xviii, 1862, 220, iii, 14*a*, *b*, *c*.

——— **kinklistheisa**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. iv, Heft 1, 1884, 32, i, 18 and 18*a*.

——— **kochii**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 96, xv, 10.

——— ——— ——— v. **lævis**, Von Hagenow. Neues Jahrbuch, 1842, 273, vii, *B*, 1.

——— **lævis**, Roemer. Verst. norddeutsch. Kreide, 1840–41, 96, xv, 11.

——— **lævigata**, Ehr. Abhandl. k. Ak. Wiss. Berlin, 1838, 135.

——— **lævigata**, Roemer. Neues Jahrbuch, 1838, 383, iii, 11.

——— ——— ——— Michelotti, Mem. Soc. Ital. Sci. xxii, 1841, 278, i, 11.

——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 657, xxiv, 12.

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——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. xiii, 1865–66 (1867), 225, i, 19.

——— **laminæformis**, Gümbel. Abh. m.-ph. Cl. k.-bayer. Ak. Wiss. x, 1868 (1870), 632, i, 48*a*, *b*.

——— **lanceolata**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 25, iii, 12.

——— **laxa**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 8, i, Posodonienschiefes, 2.

——— **legumen** (Linné). D'Orbigny, Ann. Sci. Nat. vii, 1826, 257. [*Nautilus*, 1758.]

——— ——— ——— Jones & Parker, Quart. Journ. Geol. Soc. xvi, 1860, xix, 27 and 28.

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——— ——— ——— Brady, Report Challenger, 1884, 530, lxvi, 13–15.

——— ——— ——— v. **arquata**, Brady. Report Challenger, 1884, 531, cxiv, 13.

——— ——— ——— v. **elegans** (d'Orb.). Fornasini, Boll. Soc. geol. Ital. v, 1886, 25, i, 1 ?, 2–8. [v. *V. elegans*.]

——— ——— ——— subvar. **margaritifera** (Batsch). Fornasini, Boll. Soc. geol. Ital. v, 1886, 25, i, 9–11. [v. *V. margaritifera*.]

——— ——— ——— var. Sherborn & Chapman, Journ. R. Micr. Soc. [2], vi, 1886, 753, xv, 19*a*, *b*.

VAGINULINA perspicua, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 26, iii, 15.
——— **protosphæra**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 90, xii, 10*a*, *b*.
——— ——— ——— Goës, Bihang K. Svenska Vet.-Ak. Handl. XV, 1889, ii, 29.
——— **raduliformis**, Schwager. Benecke's Geogn.-Pal. Beiträge, I, 1866, 305, fig. 7.
——— **recta**, Karrer. Novara-Exped., Geol. Theil I, 1864, 74, xvi, 2.
——— **recta**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 48, iii, 14 and 15*a*, *b*.
——— ——— ——— Zittel, Handbuch Palaeont., Abth. I, 1876, 85, fig. 21[5].
——— ——— ——— Berthelin, Mém. Soc. géol. France, [3], I, 1880, 41, ii (xxv), 5*a*–6*c*.
——— ——— ——— Goës, Bihang K. Svenska Vet.-Ak. Handl. XV, 1889, ii, 31.
——— **rotundata**, Ehrenberg. Mikrogeologie, 1854, xxxi, 7. [Near *V. marginata*, d'O.]
——— **rudis**, Deecke. Abh. geol. Specialkarte Elsass-Lothr. IV, Heft 1, 1884, 30, i, 15*a*, *b*.
——— **rugosa**, Terquem. Six. Mém. Foram. Lias, 1866, 497, xx, 34.
——— **schloenbachi**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 46, iii, 6*a*, *b*.
——— **siblingensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 34, iv, Impressathon, 7.
——— **simplex**, Terquem. Mém. Ac. Imp. Metz, XLIV, 1863, 394, viii, 1*a*, *b*.
——— **sparsicostata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 50, iv, 4*a*, *b*.
——— **spinigera**, Brady. Report Challenger, 1884, 531, lxvii, 13 and 14. [*Marginulina*, sp., Whiteaves, 1872.]
——— **striata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 257, No. 3.
——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865–66 (1867), 225, i, 20.
——— ——— ——— P., J., & B.' [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 162, ix, 58.
——— ——— ——— See *Hortoceratia vaginulam*, etc.
——— ——— ——— D'Orbigny, Prodrome de Paléont. I, 1850, 324. [*Planularia*, 1826.]
——— **striata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 182, xvi, 16*a*, *A*, *B* [error for 17].
——— **striato-costata**, d'Orb., 1847. D'Orbigny, Prodrome de Paléont. II, 1850, 185, No. 751.
——— **striatula**, Roemer. Neues Jahrbuch, 1842, 273, vii, *B*, 2.
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 657, xxiv, 14.
——— **strigillata** and var., Rss. Jones & Parker, Quart. Journ. Geol. Soc. XVI, 1860, xx, 29–35. [*Citharina*, 1845.]
——— **striolata**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 46, iii, 7.
——— **strombecki**, Reuss. Sitz. k. Ak. Wiss. Wien, XLVI, Abth. 1, 1862 (1863), 46, iii, 8.
——— **subacuta**, Ehrenberg. Mikrogeologie, 1854, xxxii, ii, 9. [= *V. leguminiformis*, Batsch.]
——— **subulata**, Ehr. Mikrogeologie, 1854, xxiv, 10. [= *V. lævigata*, Roem.]
——— ——— ——— Ehr., Abhandl. k. Ak. Wiss. Berlin, 1855, 160, i, x. [Glauc.]
——— **sulcata**, Costa. Mem. Acc. Sci. Napoli, II, 1855 (1857), 145, ii, 17*A*, *B*.
——— **tenuis**, Ehr. Mikrogeologie, 1854, xxvi, 8.
——— **transversalis**, Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 202, viii, 5 [error for 3].
——— ——— ——— Reuss' Models, No. 89, 1865 (Catal., No. 43, 1861).

VALVULINA cordiformis, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 262, xxi, 10*A*, *B*. [v. *Pulvinulina*.]
——— **cornu**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 135.
——— **decurrens**, Brady. Carbonif. Foram., Pal. Soc. xxx, 1876, 87, iii, 17 and 18.
——— **deformis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 271, No. 8.
——— **excavata**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 137, i, 43–45.
——— **fusca** (Will.). Brady, Report Challenger, 1884, 392, xlix, 13 and 14. [*Rotalina*, 1858.]
——— **gervillii**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 271, No. 7.
——— **gibbosa** ——— Mém. Soc. géol. France, [1], IV, 1840, 38, iv, 1 and 2; Facsimile in Science Gossip, 1870, 156, fig. 141.
——— **[gibba]** ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 671, xxiv, 58.
——— **globularis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 270, No. 6.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 102, xi (xix), 6*a*, *b*.
——— **globularis**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 387, iii, 42*b*, *c*.
——— **ignota**, Defr. D'Orbigny, Ann. Sci. Nat. VII, 1826, 270, No. 5.
——— **inæqualis**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 48, vii, 10–12. [v. *Discorbina*.]
——— **inflata**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 48, vii, 7–9.
——— **irregularis**, Terq. Mém. Soc. géol. France, [3], II, 1882, 103, xi (xix), 9*a*, *b*.
——— **limbata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 102, xi (xix), 7*a–c*.
——— **mixta**, P. & J. See Valvulina, Carp., Park., & Jones, Introd. 1862.
——— **oblonga**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 136, i, 40–42.
——— **ovalis**, Terq. Mém. Soc. géol. France, [3], II, 1882, 103, xi (xix), 10*a*, *b*.
——— **oviedoiana**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 103, ii, 21 and 22; also in Spanish, 1840, 108, same pl. and fig. [v. *oviedoana* on plate.]
——— **palæotrochus**, Ehr. Brady, Carbonif. Foram., Pal. Soc. xxx, 1876, 83, iv, 1–4. [*Textilaria*, 1854.]
——— ——— ——— v. **compressa**, Brady. Carbonif. Foram., Pal. Soc. xxx, 1876, 85, iv, 5*a*, *b*.
——— ——— [Br.]. Nicholson, Manual Palaeont. 1879, I, 112, fig. 21*C*, *D*.
——— ——— ——— Roemer, Lethaea Geognostica, Th. I, Lief. 1, 1880, 267, fig. 42.
——— **parisiensis** (d'Orb.). P., J., & B., Ann. Mag. Nat. Hist. [3], XVI, 1865, 29 and 35, pl. 1, f. 26. [= *Clavulina*, q. v.]
——— **parvula**, v. Muenster. Roemer, Neues Jahrbuch, 1838, 387, iii, 41*b*, *c*.
——— **pileolus**, d'Orbigny. Voyage Amér. Mérid. 1839, V, pt. 5, "Foraminifères," 47, i, 15–17. [v. *Discorbina*.]
——— **plicata**, Brady. Carbonif. Foram., Pal. Soc. xxx, 1876, 88, iv, 10 and 11.
——— **pupa**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 270, No. 2.
——— ——— ——— Terq., Mém. Soc. géol. France, [3], II, 1882, 101, xi (xix), 5.
——— **quadribullata**, v. Hagenow. Neues Jahrb. f. Min. 1842, 570.
——— **rawackensis**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 270, No. 4.
——— **rudis**, Brady. Carbonif. Foram., Pal. Soc. xxx, 1876, 90, iii, 19 and 20.
——— **spicula**, Reuss. Geogn. Skizze Böhmen, II, 1844, pt. 1, 214.
——— ——— ——— Reuss, Verstein. böhm. Kreide, 1845–46, i, 37, xiii, 69.

VERMICULUM globosum (Walker & Boys). Montagu, Testac. Brit. 1803, 523. [v. *Lagena.*] [*Serpula*, 1784.]
——— **intortum**, Montagu. Test. Brit. 1803, 520.
——— ——— ——— Fleming, Mem. Werner. Nat. Hist. Soc. IV, 1822, 564, xv, 3*a*, *b*.
——— **lacteum**, Montagu. Test. Brit. 1803, 522. [v. *Miliola* and *Biloculina.*]
——— ——— ——— Fleming, Mem. Werner. Nat. Hist. Soc. IV, 1822, 566, xv, 6*k*, *l*, *m*. [= *Polymorphina.*]
——— **læve** (Walker & Boys). Montagu, Testac. Brit. 1803, 524. [*Serpula*, 1784.]
——— **marginatum** (Walker & Boys). Montagu, Test. Brit. 1803, 524. [*Serpula*, 1784.] [v. *Lagena*, *Renoidea*, and *Biloculina.*]
——— **oblongum**, Montagu. Test. Brit. 1803, 522, xiv, 9. [v. *Miliola*, *Biloculina*, *Lagena*, *Miliolina*, *Quinqueloc.*, *Triloculina.*]
——— ——— ——— Fleming, Mem. Werner. Nat. Hist. Soc. IV, 1822, 565, xv, 4*d*, *e*, *f*.
——— **perforatum** (Walker & Boys). Montagu, Test. Brit. 1803, 519. [*Serpula*, 1784.]
——— **perlucidum**, Montagu. Test. Brit. 1803, 525, xiv, 3. [v. *Lagena.*]
——— **retortum** (Walker & Boys). Montagu, Test. Brit. 1803, 524. [*Serpula*, 1784.]
——— **squamosum**, Montagu. Test. Brit. 1803, 526, xiv, 2. [v. *Entosolenia*, *E. globosa*, and *Lagena.*]
——— **striatum** (Walker & Boys). Montagu, Test. Brit. 1803, 523. [*Serpula*, 1784.]
——— **subrotundum** (Walker & Boys). Montagu, Test. Brit. 1803, 521. [*Serpula*, 1784.] [v. *Miliola*, *Miliolina*, and *Quinqueloculina.*]
——— [**subrotundatum**], [Mont.]. Fleming, Mem. Werner. Nat. Hist. Soc. IV, 1822, 565, xv, 5*g*, *h*, *i*.
——— **urnæ**, Montagu. Test. Brit. 1803, 525, xiv, 1. [v. *Serpula*, and *Lagena.*]
——— ——— ——— = *Entosol. lineata*, Will. [Williamson] = ? ovary of a Coralline [Jeffrey].
Vermiculus saxis et lignis adhærens Cornu Hammonis referens. Plancus, De Conch. Min. 1739, also 1760, 17, pl. i, f. viii, *N*, *M*, *L*. [= ? *Serpula.*]
Verneolina, Costa ; misprint for *Verneuilina*.
Verneueilina, Williamson, 1848 ; misprint for *Verneuilina*.
VERNEUILINA, d'Orbigny, 1840. Mém. Soc. géol. France, [1], IV, 1840, 39 ; Brady, Report Challenger, 1884, 382.
——— **bronnii**, Reuss. Verstein. böhm. Kreide, 1845–46, I, 38, xii, 5.
——— [**bronni**] ——— Reuss, Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 40, iv, 2.
——— [**bronni**] ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 88, xxix[1], 15.
——— **cognata**, Reuss. Sitz. k. Ak. Wiss. Wien, L, Abth. 1, 1864 (1865), 448, i, 1.
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 98.
——— **communis** (d'Orb.). J., P., & B., Crag Foram., Pal. Soc. XIX, 1866, n. d., iii, 19. [*Clavulina*, 1826.]
——— ——— ——— Vanden Broeck, Ann. Soc. belge Micros. II, 1876, 136, iii, 14 ; and Fonds de la Mer, III (1876).
——— **compressa**, Andreae. Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 199, viii, 23 [error for 2 and 3].
——— **convexa**, Olszewski. Sprawozd. Kom. fizyj. Ak. Umiej. Krakowie, IX, 1875, 131, ii, 7.
——— **cretacea**, Karrer. Jahrb. k. k. geol. Reichsanstalt, XX, 1870, 164, i, 1.
——— **dubia**, Reuss. Haidinger's Naturw. Abh. IV, Abth. 1, 1851, 40, iv, 3.

VERNEUILINA. Deshayes, Coq. Foss. Paris, 1824–1837, not descr., cvi, 1–3.
——— Eley, Geol. in the Garden, 1859, 202, ix, 38*C*.
——— Eley, Geol. in the Garden, 1859, 197, iv, 22; v, 31. [Flint cast.] [Referred to *V. tricarinata* on p. 200.]
——— sp. ind. Andreae, Abh. geol. Specialkarte Elsass-Lothr. II, Heft 3, 1884, 296, vi, 15.
——— Folin, Congrès Scient. Dax, 1882 (1883), 325, pl., f. 9. [Sarcode body.]
Vernouilina, Eley, 1859; misprint throughout his book for *Verneuilina*, q. v.
VERTEBRALINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 283; Brady, Report Challenger, 1884, 186.
——— **cassis**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 51, vii, 14 and 15; also in Spanish, 1840, 72, same pl. and fig.
——— **conicoarticulata**, Batsch. Goës, K. Svenska Vet.-Akad. Handl. XIX, No. 4, 1882, 121, ix, 311–318. [*Nautilus*, 1798.]
——— **contracta**, Terquem. Mém. Soc. géol. France, [3], II, 1882, 45, ii (x), 19–22.
——— **elongata**, Karrer. Sitz. k. Ak. Wiss. Wien, LVIII, Abth. 1, 1868, 155, iii, 10.
——— **foveolata**, Franzenau. Földtani Közlöny, XI, 1881, 49 and 101, iii, 19–21.
——— **insignis**, Brady. Report Challenger, 1884, 187, xii, 9–11.
——— **lævigata**, Terq. Mém. Soc. géol. France, [3], II, 1882, 44, ii (x), 15–18.
——— **mucronata**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 52, vii, 16–19; also in Spanish, 1840, 72, same pl. and fig.
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 120, xxi, 18 and 19.
——— ——— ——— Reuss' Models, No. 60, 1865 (Catal., No. 26, 1861).
——— ——— ——— Zittel, Handbuch Palaeont. Abth. I, 1876, 78, fig. 12.
——— **niebuhrii**, Ehrenberg. Abhandl. k. Ak. Wiss. Berlin, 1838, 135.
——— **sarmatica**, Karrer. Abh. k. k. geol. Reichs. IX, 1877, 376, xvi, *b*, 12.
——— **striata**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 283, No. 1.
——— ——— ——— D'Orbigny, Modèles, No. 81, 1826.
——— ——— ——— Williamson, Recent British Foram. 1858, 90, vii, 196*a*, *b* [error for 197 and 198].
——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 72, v, 17–25.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 81], Ann. Mag. Nat. Hist. [3], XVI, 1865, 32, i, 1.
——— ——— ——— P., J., & B. [Soldani], Ann. Mag. Nat. Hist. [4], VIII, 1871, 239, viii, 27.
——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 27, pl., 106.
——— ——— ——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 190, iv, 17.
——— ——— ——— Jones, in Micrógr. Dict. ed. 4, 1883, 806, xxiii, 10.
——— ——— ——— Brady, Report Challenger, 1884, 187, xii, 14–16.
——— ——— ——— Anon., Sci. News, 27 Ap. 1888, 389, fig. 6.
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 162, fig.
——— ——— ——— See *Lituus*.
——— **(Articulina) sulcata**, Reuss. Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 9, i, 3–6.
——— Deshayes, Coq. Foss. Paris, 1824–37, not descr., pl. ciii, 35–39.
——— Parker, Trans. Micr. Soc. London, n. s. VI, 1858, 55.
——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 190, iv, 18. [= *Articulina*, d'Orb.]
——— Bütschli, in Bronn, Klassen, etc. Thier-Reichs, 1880, 190, iv, 19. [= *Renulina*, Lam.]

VIRGULINA tegulata, Reuss. Verstein. böhm. Kreide, 1845–46, i, 40, xiii, 81. [v. *Bolivina.*]
——— ——— ——— Reuss, in Geinitz, Grundr. Verstein. 1845–46, 682, xxiv, 79.
——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 91, xxix[1], 23; xlii, 23.
——— **tenuis**, Seguenza. Atti Accad. Gioenia Sci. Nat. [2], XVIII, 1862, 112, ii, 2 and 2*a*.
——— **texturata**, Brady. Report Challenger, 1884, 415, lii, 6*a*, *b*.
——— Pictet, Traité de Paléont. IV, 1846, 239, xii, 27.

VORTICIALIS, Lamarck, 1812. Extrait Cours Zool. 1812, 122; and Ency. Méthod., "Vers," III [1832], 1148.
——— **craticulata** (F. & M.). Defrance, Dict. Sci. Nat. XXXII, 1824, 181; Atlas, Conch. xv, 6. [= *Polystomella.*] [*Nautilus*, 1798.]
——— ——— ——— Blainville, Manuel Malac. et Conch. 1825 (pls. 1827), 375, vii, 6.
——— ——— ——— Cuvier, Animal Kingdom, Henderson's ed. III, 1834 (pls. 1837), 18, iv bis, 6.
——— **depressa**, v. **strigilata** (F. & M.). Lamarck, Ency. Méthod., "Vers," III (1832), 1148 (pls. 1827), 470, f. 2 (P. & J. quote pt. 23, 1816). [*Nautilus*, 1798.]
——— **marginata** (F. & M.). Lamarck, Ency. Méthod., "Vers," III (1832), 1148 (pls. 1827), 470, f. 3 (P. & J. quote pt. 23, 1816). [*Nautilus*, 1798.]
——— ——— ——— Brown, Elem. Foss. Conch. 1843, not descr., iii, 9.
——— **strigilata** (F. & M.), v. **craticulata** (F. & M.). Lamarck, Ency. Méthod., "Vers," III (1832), 1148 (pls. 1827), 470, f. 1 (P. & J. quote pt. 23, 1816). [*Nautilus*, 1798.]
——— ——— ——— Crouch, Introd. Lamarck, 1827, 42, xx, 15. [= *Polystomella.*]
——— ——— ——— Brown, Conch. Text-book, 1839, 60, x, 9 [error for 10].
——— ——— ——— Dujardin, Hist. Nat. Zooph. Infusoires, 1841, 258, i, 15.
——— ——— ——— Brown, Elem. Foss. Conch. 1843, 22, ii, 9.

VULVULINA, d'Orbigny, 1826. Ann. Sci. Nat. VII, 1826, 264.
——— **abrupta**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 35, iv, Impressathon, 16. [= *Textularia.*]
——— **alata**, Seguenza. Atti Accad. Gioenia Sci. Nat. [2], XVIII, 1862, 115, ii, 5 and 5*a*. [v. *Bolivina beyrichi.*]
——— **capreolus**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 264, No. 1, xi, 5, 6, 7, and 8. [v. *Bigenerina* and *Schizophora.*]
——— ——— ——— D'Orbigny, Modèles, No. 59, 1826.
——— ——— ——— Cuvier, Règne Animal, 1836–46, IX (pls. x), 34, xiv, 11.
——— ——— ——— P., J., & B. [d'O., Modèles, No. 59], Ann. Mag. Nat. Hist. [3], XVI, 1865, 28, ii, 63. [= *Grammost.* = *Vulvulina pennatula*, Batsch.]
——— ——— ——— Basset, Ann. Soc. Sci. Charente-Inf. 1884 (1885), 161, fig.
——— **eichbergensis**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 30, iii, 43 and 43*a*. [= *Textularia.*]
——— **elegans**, d'Orbigny. Ann. Sci. Nat. VII, 1826, 264, No. 3. [v. *Grammostomum.*]
——— ——— ——— = *Grammost. elegans*, d'O.; see *Orthoceratia pupa*. [= *Bigenerina.*]
——— **farcimen**, Zwingli & Kübler. Foraminif. schweiz. Jura, 1870, 30, iii, 41. [= a *Virgulina.*]
——— **gramen**, d'Orbigny. De la Sagra, Hist. Phisiq. etc. Cuba, 1839, "Foraminifères," 148, i, 30 and 31; also in Spanish, 1840, 139, same pl. and fig. [v. *Grammostomum.*]
——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 251, xxi, 46 and 47.
——— ——— ——— Carpenter, Parker, & Jones, Introd. Foram. 1862, 190, xii, 15.

WEBBINA irregularis, d'Orbigny. Prodrome de Paléont. II, 1850, 111, No. 783. [Cornuel's "Œufs de Molluscs," Mém. Soc. géol. France, 1848, pl. ii, f. 37.] [v. *Trochammina.*]

——— ——— ——— Bronn, Lethaea Geognostica, ed. 3, II, 1851–52, 91, xxix[1], 27.

——— ——— ——— Brady, Proc. Somerset. Arch. and Nat. Hist. Soc. XIII, 1865–66 (1867), 221, i, 2, 3.

——— ——— ——— Sherborn, Proc. Bath N. H. Antiq. F. Club, VI, pt. 3, 1888, 332, fig.

——— ——— ——— Howchin, Journ. R. Microsc. Soc. 1888, 539, ix, 16 and 17.

——— **lævis**, Sollas. Geol. Mag., [2], IV, 1877, 103, vi, 1–3.

——— ——— ——— Vine, Proc. Yorkshire Geol. Polytech. Soc. n. s. IX, pt. 1, 1885 (1886), 26, ii, 13.

[**WEBINA**] **lævigata**, Costa. Atti Accad. Pontaniana, VII, fas. 2, 1856, 187, xvi, 14.

——— **orbignyi**, Terq. & Piet. Terquem, Mém. Ac. Imp. Metz, XLII, 1862, 458, vi, 19.

——— **rostrata** (Quenst.). Deecke, Mém. Soc. Emul. Montbéliard, XVI, 1886, [p. 25]. [*Bullopora*, 1858.]

——— **rugosa**, d'Orbigny. Barker Webb & Berthelot, Hist. Nat. Iles Canaries, 1839, II, pt. 2, "Foraminifères," 126, i, 16–18. [v. *Nubecularia.*]

——— ——— ——— D'Orbigny, Foram. Fossiles Vienne, 1846, 74, xxi, 11 and 12.

——— ——— ——— Schwager, Boll. R. Com. geol. Ital. VIII, 1877, 26, pl., 84.

——— **scorpionis**, d'Orb. Terquem, Mém. Ac. Imp. Metz, XLII, 1862, 456, vi, 16*a–c*. [v. *Placopsilina.*]

——— **tuberculata**, Sollas. Geol. Mag. [2], IV, 1877, 104, vi, 4–9.

——— ——— ——— Vine, Proc. Yorkshire Geol. Polytech. Soc. n. s. IX, pt. 1, 1885 (1886), 26, ii, 14.

——— Gabb & Horn, Journ. Ac. Nat. Sci. Philad. n. s. V, 1862, part ii, 179, xxi, 71.

——— Quenstedt, Handbuch Petref. ed. 3, Abth. 5 (1885), 1051, lxxxvi, 16. [= *Placopsilina.*]

——— see *Œufs.*

——— see *Trochammina.*

WEBINA, Costa, 1856. See *Webbina.*

ADDITAMENTA ET CORRIGENDA.

ALVEOLINA montipara, Ehr. For xxxviii read xxxvii.
AMMONIÆ. Line 3; *T*, *V*, are near *Pulvinulina elegans*.
AMMONICERINA. For 51 read 15.
AMPHISTEGINA lenticula (Defr.). Jones, Catal. Foss. Foram. B. M. 1882, 50. [v. *Nummulites lenticularis*.]
ANNULINA. Line 3; for Pornemann read Bornemann.
ANOMALINA polymorpha. Costa's reference should read 7–9.
——— Williamson, 1848. Corrected to *Globigerina bulloides* in 1872.
ARTICULINA arcuata, Deshayes. Ency. Méth. (Vers), 1830, 75.
ASSILINA placentula (Desh.). Jones, Catal. Foss. Foram. B. M. 1882, 65. [v. *Nummulites*.]
ATAXOPHRAGMIUM. For **suborale** read **subovale**.
BATHYBIOPSIS, de Folin. Le Naturaliste, 1887, 103, figg. 1, 2, 3.
——— **astrorhizoides**, de Folin. Sous les Mers, 1887, 221, f. 22. [Here spelled *Bathypiopsis*.]
BIFARINA. Schwager refers to but does not figure this form.
BILOCULINA amphiconica. Reuss, 1867, in description of plate calls this, var. *platystoma*, and at p. 68, says that he had previously described it under specific name of *platystoma*.
——— **opposita**, Deshayes. Ency. Méth. (Vers), 1830, 138.
——— **seguenziana**, Forn. Transfer to *Lagena*; entered here in error.
——— Carpenter. For 374 read 376.
BIOMYXA, Leidy, 1875. Proc. Ac. Nat. Sci. Philad. 1875, 123.
——— **vagans**, Leidy. *Ibidem*, 124; and Report U. S. Geol. Surv. Territ. XII, 1879, 281, xlvii, 5–12; xlviii.
BOLIVINA beyrichi. Terrigi, 1880, 198 describes figg. 43 and 45 as v. *carinata*; Mariani, Atti Soc. Ital. Sci. XXXI, 1888, describes 102, xxxi, 3 as v. *lobata*.
——— **biformis**, Eley. Jones, Catal. Foss. Foram. B. M. 1882, 15.
——— **obsoleta**, Eley. Geol. in the Garden, 1859, 195, ii, 11; 202, viii, 11*c*. [v. *Textularia*.]
——— ——— ——— Jones, Catal. Foss. Foram. B. M. 1882, 15.
BORELIS palæophus. Should read **palæolophus**.
BUCCININA. In description of plate on p. 48, Costa calls this genus *Buccinulina*, and makes the specific names *afra* and *irregularis*.
BULIMINA buliminoides (Rss.). Jones, Catal. Foss. Foram. B. M. 1882, 78. [v. *Rotalia*.]
CALCARINA atlantica. Ehrenberg's description is obscure; it may be he refers to pl. xxxv, *A*.
——— **rarispina**, Deshayes. Ency. Méth. (Vers), 1830, 164.
CAPSULINA. Are not these pedicellariæ of echinoderms?
CEOPHONUS, Bosc. Nouv. Dict. Sci. Nat. v, 1816, 491; founded on one of Fichtel & Moll's forms, but which, is not stated.
CLADOCERA manipulata?, Mich. Abich's figure (Mém. Ac. Imp. Sci. St. Pétersbourg, [6], VII, 1859, viii, 2*c*) seems to be a section of a *Spiroloculina*.

CLAUSULUS. Should come before *Clavulina.*
CLAVULINA corrugata, Deshayes. Ency. Méth. (Vers), 1830, 242.
——— **irregularis,** Deshayes. *Ibidem.*
CORNUSPIRA archimedes. Read **archimedis.**
COSC NOSPIRA. P. 47 ; should read **COSCINOSPIRA.**
COSKINOLINA. Is not figured by Schwager.
CRISTELLARIA caleata. Read **cælata.**
——— **elongata,** K. & Z. Altered to *turbinoides,* 1870.
——— **exserta,** Eichwald. Leth. Rossica (Moy. période), 1868, 184, xv, 9.
——— **fittoni,** Berthelin. Mém. Soc. géol. France, [3], I, 1880, 49, replaces *C. lævigata,* Reuss.
——— **forestii,** Fornasini. Boll. Soc. geol. Ital. IV, 1885, 113.
——— **hamiformis,** Reuss. Sitz. k. Ak. Wiss. Wien, XLVI (1), 1862 (1863), vii, 4. [Described also as *cephalotes,* q. v.]
——— **mermis,** Terq. Misprint by Terquem for *inermis.*
——— **osnaburgensis.** Should read **osnabrugensis.**
——— **recta,** d'Orb. Reuss, 1874, makes 2 var. *hamosa.*
——— **rotulata.** Schlumberger, Journ. Cincin. Soc. N. H. v, 1882, 119, v, 2, 2*a*.
——— ——— Jones, 1884 ; add fig. 7 (marginuline variety).
——— ——— P. 68 ; for Bronn, 1853, read Brown.
——— **squammula.** Add, Macgillivray, Conch. Text-book, 1845, 72, x, 25.
——— **tangentialis,** Reuss. Denkschr. k. Ak. Wiss. Wien, XXV, 1865 (1866), 143.
——— **turgida,** Reuss. Should read **turgidula.**
——— **zittlei,** Schw. Should read **zitteli.**
——— sp. Schw. Is given as *Dentalina,* on p. 112 of Schwager's paper.
CYCLAMMINA. For note concerning other supposed species, see de Amicis, Nat. Sicill. XIV, 1895.
CYCLOGYRA, S. V. Wood. Ann. Mag. Nat. Hist. IX, 1842, 458, v, 5. [= *Cornuspira.*]
DENDROPELA multiramosa, de Folin. Le Naturaliste, 1887, 113, figg. 5 and 6.
——— **typicum,** de Folin. Sous les Mers, 1887, 159, fig.
DENTALINA edelina. See *Nodosaria,* infra.
——— **fortinensis.** Should read **fontinensis.**
DILLINA, Schlumberger. Comptes Rendus, XCVI, 1883, 862. [Nomen nudum.]
DISCORBINA valvulata. Brady ; for lxxvii read lxxviii.
FABULARIA discolites. Bronn is author of specific name ; add p. 43 to his reference.
FLABELLINA baudouinana. Spelled *baudouiniana* by d'Orbigny.
——— **rugosa.** Beudant ; is *Frondicularia* in Millett's copy.
FRONDICULARIA cordai. Reuss makes var. *tribrachiata* on p. 108 of Verst. Böhm. Kreide, II.
——— **subovata,** Deshayes. Ency. Méth. (Vers), 1830, 146 (T*).
FUSULINA verneuli. Should read **verneuili,** and the reference is ii, 2*a*–*g*.
FUSULINELLA struvii. The plate should be ii ; Möller is in error.
GLANDULINA inflata. Haeusler, 1887 ; for 179 read 189.
GLOBIGERINA bulloides. Williamson, 1858 ; as these forms are said to be arenaceous, they are probably *Haplophragmium globigeriniforme.*
——— ——— v. **rubra.** To Vanden Broeck's reference add fig. 7.
——— **glomerata.** In the French edition of Hoernes called *conglomerata.*
——— **omphaloletras.** Should read **omphalotetras.**
GLOBULINA minima, Bornemann. Zeitschr. deutsch. geol. Ges. VII, 1855, 344, xvii, 3.
——— **papillata,** Costa. Atti Acc. Pontan. VII (2), 1856, xviii, 2.
GRAMMOSTOMUM convergens. Fig. 26 is described as *divergens.*
——— **megaloglossum.** Is *megaglossum* in descript. of plate.
——— **polytheca.** For xxxiii read xxiii.

GROMIA dujardini, Schultze. Organ. Polyth. 1854, 55, vii, 1–7.
——— **fluviatilis**, Duj. Micro. Dict. ed. 2, 1860, 324, xxiv, 15.
——— **gracilis**. To Möbius, add p. 17.
——— **oviformis**. To Möbius, add p. 15.
GYPSINA melobesioides. Add at end [v. *Polytrema plana.*].
HELICITEN. Add Schmidel, Fortg. zu Vorst. merkw. Verst. 1793, 32, xviii, xxi, and xxii.
HETERILLINA, Schlumberger. Comptes Rendus, XCVI, 1883, 862. [Nomen nudum.]
HETEROSTEGINA papyracea. Seguenza makes vii, 2, var. **gigantea**.
HOLOCOCCUS. Delete 7–.
HYBRIDINA obliqua. Called *Vaginulina laxa*, 1870.
HYMENOCYCLUS. Add, **discus** (Rüt.), xv, 7; **fortisii** (d'A.), xv, 2; **ephippium** (Schl.), xv, 4; **patellaris** (Schl.), xv, 1; Eichwald, Leth. Rossica (Moy. période), 1868, 185, etc.
LAGENA formosa foveolata. Should read **LAGENA foveolata**.
——— **globosa**. Terrigi, 1889; for iii read 111.
——— **gracilicostata**, Reuss. Should read **gracilicosta**.
——— **gracilis**. Reuss, 1862; add at end, and v, 62.
——— **isabella**. Reuss' fig. 50 is described as var. *raricosta*, d'Orb.
——— **lævis**. Jones, 1884; for XI read XLI.
——— **laticostata**, T. & B. Should read **laticosta**.
——— **pulchella**, Brady. Balkwill & Wright's is the trigonal form.
——— **reticulata** (Macgill.). Add Reuss before Sitz.
LINGULIÑA. Add **furcillata**, **rediviva**, and **stillula**, which have been inserted in error under *Lingulinopsis*.
LINGULINOPSIS seguana. Should read **sequana**.
——— See *Lingulina*, supra.
LITUOLA. Millett thinks Deshayes' figures (1837) are mainly *Haplophragmia* and *Peneroplides*.
LITUUS abbaticus, Spalowsky. Testac. 1795, 9, i, 9.
MARGINULINA affinis, Neugeboren. Ver. Mitth. Siebenburg. Ver. Nat. II, 1851, 144.
——— **splendens**. Out of alphabetical order.
——— **tumida**. Reuss makes this *Cristellaria* in Denkschr. k. Ak. Wiss. Wien, XXIII, 1864, 138.
——— sp. Von Dunikowski; add fig. 78.
——— sp. Schwager; for 109 read 108.
——— sp. Williamson; ascribed in 1872 to *Vaginulina costata*.
MELOSSIS, Oken. Lehrbuch Naturg. III (1), 1815, 333. [Founded on *Nautilus pompilioides*, F. & M.]
NODOSARIA annulata. For ——— read Reuss.
——— **bitziana**. Should read **bilziana**; also for **bietziana** read **bielziana**.
——— **capitata**, v. **costata**. Should read **ecostata**.
——— **congrua**, Eichwald. Leth. Rossica (Moy. période), 1868, 171, xv, 17.
——— **conica**, v. **coarctata**. For 44 read 42.
——— **conspurcata**. Reuss, Denkschr.; this is corrected to *subcostulata* in Sitz. LXII, 1870, No. 41.
——— **edelina**. For 7 read 17; this is *Dentalina*.
——— **fortinensis**. Should read **fontinensis**.
——— **gigantea**, P. & M. This is not a foraminifer.
——— **globosa**, Eichwald. Leth. Rossica (Moy. période), 1868, n. d., xv, 16.
——— **granosa**, Eichwald. *Ibidem*, 172, xv, 19. [*punctata* in text.]
——— **hispida**. For Hartwig read Harting, and add fig. 37^2 to Schwartzkopf.
——— **javanica**. Add viii after vii.
——— **longisulcata**. Mackie's reference is an error for *longiscata*.
——— **monilis**. Add var. **gracilis**, Silvestri, p. 75.
——— **raphanus**, v. **coarctata**, Silvestri. This is a var. of *raphanistrum*.

NODOSARIA rugosa. Mackie's reference is an error for *semirugosa*.
——— **scalaris** (Batsch). Add to Brady; var. **separans,** 511, lxiv, 16–19.
——— **scalaris,** d'Orb. Add var. **nonglobosa,** Silvestri, p. 57.
——— **tenuicosta** [Reuss]. Eichwald, Leth. Rossica (Moy. période), 1868, 171, xv, 18.
——— sp. Wisnoski. Should read Wisniowski.
NONIONINA compressa. Roemer confuses two figures; this should be 34.
——— **germanica.** For Hartwig read Harting.
——— Millett makes the following notes: *bathyomphala* = *Anomalina*; *compressa*, Roem., and *macromphalus* = *Cristellaria*; *heteropora* = *Polystomella*; *pelagica* = *Hastigerina*; *quatriloba*, *quaternaria*, and *subcarinata*, d'Orb. & Seg., all = *Pullenia*.
NUMMULARIA comptoni (J. Sow.). J. de C. Sowerby, Min. Conch. VI, 1826, 74 and 76. [*Nautilus*, 1816.]
NUMMULITES tuberosus, Eichwald. Leth. Rossica (Moy. période), 1868, 181.
——— De Roissy, in Buffon, Hist. Nat. (Sonnini's), Mollusques, V (an xiii), records the following: *depressa*, p. 56; *lævigata*, 55; *mamilla*, 57; *plana*, 56; *ovata*, 59; *radiata*, 58; *spira*, 57; var. *rucosa*, 58.
PLANORBULINA haidingeri. Brady, 1864; for ii read 11.
PLANULARIA matutina. Should be *Cristellaria*.
PLANULINA osnabrugensis. For 5–8 read 58.
PLECTINA. Marsson (p. 160) assigns to this genus *Gaudryina ruthenica*, Rss.
PLEUROSTOMELLA. Seguenza, Atti Acc. Lincei [3], XII, 1880, proposes but does not figure: *costæ*; *cylindrica*; *nodosaria* (p. 226); *inflata*, *involvens* (227); *obtusa* (307).
POLYMORPHINA confluens, Eichwald. Leth. Rossica (Moy. période), 1868, 172.
POLYSTOMELLA arctica. Brady, Ann. Mag. [5], i, should be 1878.
RAMULINA kittlii, Rzehak. Verh. k. k. geol. Reichs. 1885, 187.
RHABDOGONIUM. For **globiferum** read **globuliferum.**
——— **szaboi.** Genus altered to *Clavulina* in 1875.
ROBULINA comptoni. Roemer confuses two figures; this should be 33.
——— **depauperata.** To Reuss, 1863, add 66, viii, 90*a*, *b*; and var. **callifera,** fig. 91.
——— **ferruginea,** Terq. Should be *Rotalina*.
——— **gravida.** Seguenza makes figg. *b*, *c*, var. *paucisepta*; *d*, *e*, var. *multisepta*; *f*, var. *discoidea*; and a fourth variety he calls *anormalis*.
——— **inornata.** Egger, 1857; for xiv read xv.
ROSALINA foveolata. iv, μ, is Ehrenberg's error; should be vi, μ.
ROTALIA perforata. Ehrenberg, 1854; for xxxviii read xxvii.
ROTALINA ferruginea, Terquem. Bull. Soc. géol. France, [3], IV, 1876, 496, xvii, 11.
——— **inflata,** Terq. The 1875 and 1881 forms differ; in the "Tableau" and "Explic. planche," Terquem alters the 1881 form to *utriculata*.
——— **micheliniana.** Eley, Geol. Garden, 1859, 198, v, 27. [*micheliana*.]
——— **nitida.** *Ibidem*, 198, v, 24–26.
SPHÆROIDINA variabilis. Reuss, 1863, calls this "var. *conica*."
SPIRILLINA latiseptata. Williamson does not name this in 1848, but in 1872 he refers it to *S. perforata*.
——— **margaritifera.** Halkyard, Trans. Manchester Micr. Soc. 1889, 71, ii, 7.
SPIROLOCULINA canaliculata. Costa; for 98, 10 read 9, 10; Vine, for 52 read 53.
——— **nitida.** Terquem, 1882; for 6*a*, *b* read 16*a*, *b*.
SPIROPLECTA americana. First line, for 35 read 25.
——— **rosula.** For 36 read 26.
STREBLUS tortuosus. Prof. Rupert Jones points out that this specific name is d'Orbigny; see *Turbinulina tortuosa*, Ann. Sci. Nat. VII, 1826, 275. Fischer used the word to define the generic name.

TEXTULARIA agglutinans, v. **porrecta,** Brady. Report Challenger, 1884, 364, xliii, 4.
——— **carinata,** d'Orb. 1826, for 13 read 23.
——— **flexuosa,** Reuss. Sitz. k. Ak. Wiss. Wien, XL, 1860, 91. [*T. articulata*, 1851.]
——— **inflata,** Ehr. Mikrogeol. 1854, xxxii, ii, 13. (Remove from *globulosa* in "Index.")
——— **laminaris,** Costa. 1856, add fig. 17.
——— **minuta,** Berthelin. Mém. Soc. géol. France, [3], i, 26. (Replaces *pygmæa*, Reuss.)
——— **obtusa,** varr. **inflata** and **maorica.** Stache, 1864, so named in expl. to plate, but in text they appear as *antipodum* and *robusta.*
——— **pristis,** Costa. Atti Accad. Pontan. VII, fas. 2, 1856, 292.
——— **striata,** Ehr. Mikrogeol. 1854, xxviii ; fig. 7 is described as *dilatata.*
——— Williamson, 1848. Altered to *Bolivina punctata* in 1872.
——— Chimmo, 1870. Is named *variabilis.*
UVIGERINA. Brady, Challenger, 1884, 573, 575, lxxiv, 24–26, describes a variety intermediate between *pygmæa* and *aculeata.*
VAGINULINA badenensis, Costa, 1856. Also described as *Marginulina inversa*, q. v.
——— **elongata,** Roemer, 1841. Figure should be 13.
——— **harpa,** Roemer, 1841. Figure should be 12.
VALVULINA subrhombica, Stache. Denkschr. k. Ak. Wiss. Wien, XLVI, 1883, 408, vii, 31.
VERTEBRALINA, Deshayes, 1824–37. These are apparently *Articulina nitida.*
VIRGULINA schreibersii, Schwager, 1883. 12 is Schwager's error for 10.

The following nomina nuda were given to Von Schlicht's specimens from Pietzpuhl, by Reuss in "Zeitschr. deutsch. geol. Ges." x, 1858, pp. 433–438 : —

Cornuspira cassis ; polygyra.
Dentalina anomala ; bennigseni ; declivis ; fusiformis ; grandis ; indifferens ; inflexa ; isotoma ; laxa ; leptosoma ; nutans ; obtusa ; scolex ; soror ; subcostulata ; xiphidium.
Fissurina acuta ; angustimargo ; mucronata ; oblonga.
Glandulina æqualis ; armata ; amphioxys ; bipartita ; dolichocentra ; elliptica ; globulus ; gracilis ; obtusata ; obtusissima ; strobilis ; suturalis.
Lagena amphora ; angustissima ; centrophora ; coronulata ; decrescens ; elliptica ; emaciata ; frumentum ; globosa ; gracilicosta ; lepida ; mucronulata ; oxystoma ; punctigera ; reticulosa ; siphonifera ; tubulifera.
Marginulina acuaria ; crassiuscula ; fallax ; mucronulata.
Nodosaria anomala ; bactridium ; bornemanni ; calomorpha ; dacrydium ; ewaldi ; inconspicua ; isomera ; isopleura ; pedunculata ; sceptrum ; schlichti ; tubulosa.
Psecadium elongatum.

[In studying Von Schlicht's paper attention should be given to Reuss' second publication on this correction (Sitz. k. Ak. Wiss. Wien, lxii, 1870), in which he renames and confuses numerous forms. The paper is also full of error and misquotation.]

The following forms are described and illustrated in R. Haeusler's "Microgeologische Untersuchungen der jurassischen Sedimentärgesteine. I Theil. Die microscopischen Structurverhältnisse der Aargauer Jurakalke, mit besonderer Berücksichtigung ihrer Foraminiferenfauna." (Als Dissertation gedrückt.) 8vo, Brugg, 1881, 47 pp. 2 pls.[1] I give the full list of new names for reference. The plates are very bad, — it is difficult to see the utility of publishing such caricatures, — and from the numerous corrections by the author in the copy before me, the book might well have been left in oblivion.

Cornuspira minima, p. 26 ; *sinemurensis*, 15.
Cristellaria birmenstorfensis, 27 ; *complanata*, 26 ; *difformis*, 27 ; *helvetojurassica*, 17 ; *irregularis*, 17 ; *pusilla*, 18 ; *pygmæa*, 26 ; *reniformis*, 27 ; *sinemurensis*, 17 ; *vocetica*, 38.

[1] Seen too late for insertion in proper order.

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THE SUMMIT OF MOUNT HAMILTON IN THE WINTER.

Smithsonian Miscellaneous Collections.

—— 1035 ——

MOUNTAIN OBSERVATORIES

IN

AMERICA AND EUROPE.

BY

EDWARD S. HOLDEN,

Director of the Lick Observatory.

CITY OF WASHINGTON:

PUBLISHED BY THE SMITHSONIAN INSTITUTION.

1896.

The Knickerbocker Press, New York

PREFACE.

During the summer of 1873 I spent a long vacation in the mountains of central Colorado, and made special observations to compare the conditions of vision there with those in the eastern parts of the United States. The 26-inch telescope was then nearly ready to be established at the United States Naval Observatory in Washington and the question was proposed on many sides whether so powerful an instrument ought not to be installed at some elevated station in the range of the Rocky Mountains. In 1878, and again in 1885, I visited Colorado and gave attention to the same questions. During the year 1874 the first plans for the Lick Observatory on Mount Hamilton were made and from that time until its completion in 1888 the subject of mountain astronomical stations was constantly in my thoughts. From 1888 until the present time all my work has been done at Mount Hamilton, and I have thus had opportunities to compare the conditions here with those at nearly every observatory in the United States, and with stations in Great Britain, Hawaii, and the South Pacific Ocean.

It has seemed to be worth while to collect in one place the many scattered notices of the conditions of good vision at mountain stations all over the globe, and to make a short study of them. I have therefore taken pains to bring together, from astronomical and other journals, such notices as I could find and to present at least an abstract of them. If any important papers have been overlooked I must beg indulgence on the score of the great distance of Mount Hamilton from extensive scientific libraries. Should errors be found in what is here presented, I request a notice of them, in order that they may be corrected. As the questions involved are of popular, as well as of scientific, interest I have endeavored to present them as simply as possible.

EDWARD S. HOLDEN.

THE LICK OBSERVATORY, MOUNT HAMILTON,
March 21, 1896.

ILLUSTRATIONS.

MOUNTAIN OBSERVATORIES IN AMERICA AND EUROPE.

By Edward S. Holden.

INTRODUCTION.

The main object of the present paper is to study the conditions suitable for *astronomical* work at high levels. It has been necessary to examine the records of meteorological mountain-stations to obtain some of the required data; and the physiological questions involved could not be passed over, since, after all, the observer must be at the full height of his powers if he is to advance Science. But meteorological and physiological questions are here quite subordinate to the main purpose of the paper, which relates chiefly to purely astronomical matters.

It is interesting to note the expansion of the ideas connected with telescopic observation. Galileo and Kepler, (1609), considered the telescope alone. It was an optical instrument. When it was perfect, nothing more needed consideration. Newton (1717), whom nothing escaped, saw that vision might be better in the pure air of high mountains.

If the theory of making telescopes could at length be fully brought into practice, yet there would be certain bounds beyond which telescopes could not perform. For the air through which we look upon the stars is in a perpetual tremor, as may be seen by the tremulous motion of shadows cast from high towers, and by the twinkling of the fixed stars. The only remedy is a most serene and quiet air, such as may perhaps be found on the tops of the highest mountains above the grosser clouds. *

Sir William Herschel was the first to consider the observer as a part of the apparatus. In 1782 he points out that to obtain the best results the observer, the air, and the instrument must be of one temperature. In 1794 he says, while re-observing the belts on *Saturn* and noting changes that had occurred: "I took care to bend my head so as to receive the picture of the belts in the same direction as [formerly] —as there was a possibility that the vertical diameter of the retina might be more or less sensitive than the horizontal one."

**Optics*, second edition, 1719, p. 107.

The investigations of Gauss and others for the telescope, and of Helmholtz and others in the optics of the eye, have taught us the imperfections of both these optical instruments. Newton's suggestion of 1717 has been carried out, in one form or another, by Bond (1851), Lassell (1852), Piazzi-Smyth (1856), and others, and has resulted in the foundation of mountain observatories like those of Mount Hamilton, Etna, Nice, etc. Galileo's tower at Arcetri is the forerunner of the magnificent establishments of modern times. The greatest telescopes of the world are but consequences of his "optick tube."

In the paragraphs which immediately follow I have brought together short accounts of the principal steps in the evolution of the idea of the modern observatory and its requirements. The succeeding chapters will treat the more important of these in still greater detail.

François de Plantade, an astronomer and geodesist of Montpellier (*b.* 1670, *d.* 1741), a colleague of Cassini, first proposed an astronomical observatory on the Pic-du-Midi, (9439 feet), and made several ascents with that end in view. He died, in fact, on the mountain while engaged in observations. The noted Chevalier D'Angos, it is said, made a series of astronomical observations at this station. In 1860 (July 18) a solar eclipse was photographed from the summit. It is worthy of note that the altitude of the station is the same as that of Quito, Ecuador.

In 1821–2–3 Sir John Herschel and Sir James South re-observed a number of Sir William Herschel's double-stars at Sir James South's London observatory. Finding that the conditions existing there were not satisfactory, Sir James South, in 1824, transported his largest telescope (aperture 5 inches) to Passy, in France, where the work was continued. This was, I believe, the first astronomical expedition in search of improved conditions. It was, however, entirely unnecessary to move a 5-inch telescope out of England in search of a climate. The southern counties, Sussex, etc., would have provided good observing stations.

In various works, Alexander Von Humboldt called attention to the steadiness of the stars in the tropics, where the distribution of temperature is more regular than in our temperate regions. On the rainless deserts of Peru the stars generally cease to twinkle at an altitude of 10° to 12°. In Arabia, India, and on the shores of the Persian Gulf similar conditions are said to prevail.

In the year 1851 a total solar eclipse occurred in Norway. The corona was observed by Professor G. P. Bond, Director of Harvard College Observatory, among others. Before leaving Norway, Bond determined to search for the corona by occulting the sun in full daylight, selecting some high station with an atmosphere free from dust

and therefore from "glare" about the sun. From Norway Bond proceeded directly to Switzerland, where the experiment was tried.*

The 2-foot reflector constructed by Lassell and mounted by him near Liverpool was taken to Malta in 1852 chiefly for the purpose of obtaining better views of the planets. The 4-foot reflector, also constructed by Lassell in 1859, was mounted at Malta during 1861 and remained there until 1865. The change from England to Malta was made in search of better astronomical conditions; and it is noteworthy that Lassell's first expedition (1852) antedated the Teneriffe experiment by four years. Sir John Herschel's expedition to the Cape of Good Hope was not in search of better conditions but for the purpose of making a survey of the southern sky.

In the year 1856 Professor Piazzi-Smyth made his famous expedition to Teneriffe, where he established telescopes of sufficient power at two stations of altitudes of 8903 and 10,702 feet, respectively. The whole question of good vision † was thoroughly studied during a two months' stay. The effects of fogs, local clouds, wind, dust, moisture, etc. were noted. The general conclusion was extremely in favor of that particular mountain-station.

The results of the expedition were printed in scientific journals and also in a popular book which had a wide circulation.‡ There is no doubt that this expedition served to attract general attention to the matter of choosing suitable sites for observatories; and also to spread the idea that *all* mountain-stations possessed striking advantages.

Lassell's expedition of 1852 was, however, the first practical recognition of the fact that a large telescope can only do its work well under conditions specially favorable. These conditions *may* be found on a mountain, or (for some work) they *may* be found at sea-level, as at Malta. If the necessity for a specially favorable site be once recognized, the search for the proper conditions is a matter of detail. The credit for a clear comprehension of the conditions necessary for a great telescope we must give to Lassell.

Captain Jacob, a keen-sighted observer, early recognized the advantages of a good observing station. At the time of his death (1862) he had procured a 9-inch refractor which he intended to mount in the Nilgiri Hills (Southern India).

A letter from Dr. Henry Draper to Professor George P. Bond (dated November 21, 1864) suggests that the best place to establish a

* The *American Journal of Science*, 3d series, vol. x, pp. 81–83, contains accounts of this experiment extracted by the writer from Professor Bond's Ms. diary, by permission of his daughters.

† Good "seeing," as it is called in the United States—following a convenient expression which we owe, I think, to the veteran observer, Alvan Clark.

‡ *Teneriffe—An Astronomer's Experiment.*

large telescope for use in celestial photography might be on the west coast of South America, near the equator (for instance, in the neighborhood of Quito), and at a considerable altitude above the sea. A generation later this suggestion was realized in the Harvard Station at Arequipa.*

The first recognition by a scientific body of the matter in question was by the American Association for the Advancement of Science at its Chicago meeting (1868). Its action in 1868 was followed up by the appointment of a committee to memorialize Congress, in 1870. It is worth while to quote its resolutions in full, as they led to important results.

Resolved, That this Association recommends to the attention of those who would make intelligent and munificent endowments of scientific institutions, the importance of an Astronomical Observatory at some point on the Pacific Railroad between Nebraska and the Pacific Coast, and at as high an altitude as possible, where the clearness of the atmosphere and the great number of cloudless days would ensure remarkable and unsurpassed opportunities for astronomical observations.† [Adopted at the Chicago meeting, August, 1868.]

Resolved, That a committee of three be appointed to memorialize Congress on the importance of establishing an observatory and maintaining a scientific corps, for a year or more, at one of the highest points on the Pacific Railroad, and particularly at the eastern rim of the Utah Basin. [Adopted at the Troy meeting, August, 1870.]

The committee appointed consisted of J. E. Hilgard, Joseph Henry, and J. H. C. Coffin, and Congress was asked for an appropriation. A sum was granted, and the disbursement was put under the charge of the U. S. Coast Survey.

The subject must have been widely discussed among scientific men in America, for on several occasions before 1866 my honored friend and instructor, Professor William Chauvenet, explained to me the advantages to be gained from mountain-stations for astronomical observatories.

In the year 1872 the expeditions of the U. S. Coast Survey, under Professors Young and Davidson, and Mr. Cutts, were stationed in the Sierras and at Sherman (Wyoming); and the great success of Professor Young's solar spectroscopic researches at the latter station was soon widely known. In 1872–3 the question of a suitable site for the 26-inch telescope of the Naval Observatory was frequently discussed among astronomers. In 1873 I made a stay in Colorado and reported (adversely) on the placing of a great telescope in any of the stations

* I owe the knowledge of this unpublished letter to my cousin, Miss Elizabeth Bond, who has placed copies of her father's correspondence in my hands.

† It is noteworthy that nothing is said about the necessity for a steady atmosphere—the most important factor.

which I had occupied. In 1874 Mr. Lick proposed to found a mountain observatory, and the first plans for the Lick Observatory were made. An essential part of the programme was that the site should be selected only after telescopic comparisons had been instituted between the various stations proposed. Such an examination was actually made by Professor Burnham in 1879, after the present site for the Lick Observatory had been selected, but before any work had been done.

The eclipse-expeditions of 1878 to the Rocky Mountain region, familiarized many observers with the question; and the expedition of Dr. Langley to Mt. Whitney in 1881 exhibited the excellent conditions to be obtained there. The first regular astronomical observations were made at Mt. Hamilton (double stars; the transit of *Mercury*) in 1881, and the transit of *Venus* was observed (photographed) with excellent results in 1882. All these observations were published and did their part in calling attention to the problem. The observatory on Etna, built in 1881, but proposed by Professor Tacchini as early as 1871, performed the same part in Europe. It may fairly be said that the many mountain observatories now built, or building in all parts of the globe owe much to the experience gained at the establishments on Etna and at Mt. Hamilton.

These establishments themselves are the legitimate outcome of the proposal of Sir Isaac Newton in 1717, of the Malta expedition of Lassell in 1852, and of the Teneriffe experiment of Piazzi-Smyth in 1856.

The inhabitants of the earth know the external universe directly, only through the sense of sight; and our terrestrial views of the planets and stars are much modified by the action of our own atmosphere upon the rays of their light which reach our eyes. We are, as it were, immersed in an ocean of air, and one of the first problems of astronomical physics is to determine the effect of this overlying ocean upon the light from external bodies which penetrates its depths. Light moves in straight lines in empty space; but light entering our atmosphere is refracted from its course so that the ray which enters our eye from a star no longer travels in its primitive direction.

By the effect of refraction every star is seen not in its true place but displaced. Moreover the atmosphere does not permit all the light of the star to reach us. A certain quantity—percentage—is absorbed in its passage through the atmospheric envelope, and the star appears fainter to us in fact, than it would were the atmosphere removed. It appears less bright near the horizon than near the zenith. Not only is the *quantity* of incident light changed by the general absorption, but its *quality* is affected also by a selective absorption special to our air. Bodies appear redder than they really are. The blue light

is more absorbed, proportionally, than the red. A familiar example of this is shown in the redness of the setting sun. If we measure the heat which comes to us from the sun we shall find that it is refracted, altered in quantity and also in quality by our own atmosphere.

One of the chief problems of astrophysics is to evaluate the amount of these alterations, so as to obtain the true and not merely the apparent effect of celestial radiations.

In order to measure the effect of the earth's atmosphere in these regards there are two obvious experimental methods. The observer may, first, remain in the same place, and make his measurements when the heavenly body is near the zenith (when its rays traverse the least depth of air) and again, when it is near the horizon (when its rays traverse the maximum depth). By a comparison of such observations the effect of the atmosphere can be concluded. Or, again, the observer may occupy two stations, one near the sea-level (and thus under the whole of the atmosphere), the other on a high mountain (and thus free from the effect of the air beneath). A comparison of such measures will, again, determine the influence of the earth's envelope. In many of the delicate problems of astronomy and physics, recourse must be had to both these devices. High-level observing stations are called for in many special researches.

Stars seen from the summit of a high mountain of about 10,000 feet in altitude appear considerably brighter than from sea-level, and the effect to an observer seems to be a brightening of the whole heavens.

This brightening is, however, not uniform over the entire sky. Stars at and near the zenith are but slightly more brilliant, while those near the horizon are about two and a half times brighter than at sea-level. The very vivid impression made upon an observer who first sees a clear night-sky from a high peak is chiefly due to the marked increase in the brilliancy of the stars, and of the Milky Way, close down to the horizon.*

If while the stars are more brilliant, because the air is more transparent, they are at the same time more steady (twinkle less), because the air is more tranquil, the advantages of a mountain station for astronomical purposes become very great. If these advantages are noteworthy for observations made with the eye and telescope, they are still more so when the eye is replaced by the photographic plate. The blue rays pass through the higher air relatively more freely than through the lower and denser.

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* At an elevation of 14,000 feet in the Sierras and Rocky Mountains the sky, on a cloudless and smokeless day, is *violet*, not blue. The skies of the paintings of Bierstadt, Moran, and others seem false to those who have never lived at these high altitudes, but they are not so.

At the Lick Observatory *both* the advantages named above are secured; that is, increased transparency and greatly increased steadiness. The astronomical observations made on the Säntis show the same to be sometimes true at this station, though both advantages are rarely secured at high mountain-stations.

In astronomical observations it is desirable that the image of the star under examination should be as bright as possible; and as steady as possible—as free from twinkling, as has been said. Of the two requirements the second is far more important for all observations in which accurate measures of the positions of stars are needed; and in most spectroscopic observations.

A striking demonstration of the relative importance of the two factors is often afforded during the times when a fog is slowly forming in the atmosphere. While the air is perfectly clear, both components of a double star, for example, seen through the telescope, will appear quite brilliant, but each component will be so unsteady (will twinkle so) that measures of their distance apart will be difficult to make. As the fog comes on, its effect is to equalize the temperatures of different layers of the atmosphere and thus to increase the *steadiness* of the star. At the same time another effect of the fog is to absorb some of the star's light and thus to decrease its brilliancy.

If the fog forms slowly, it is instructive to watch the gradual changes in brilliancy and to note how little effect these changes have upon the measures; and to remark, on the other hand, the great increase of precision in the measurements due to the increased steadiness of the star-images.

A transparent air is very desirable; a steady air is essential for most astronomical work.

The conditions which produce steady seeing depend, in general, upon the arrangement of the layers of atmosphere above the observing station. If we imagine the observer to be situated on an extensive level plain, as on the steppes of Russia, a small island in the tropical ocean, or the plains of Lombardy, and if the air is quite still, the separate layers of the atmosphere will be arranged in strata parallel to the earth's surface. The lowest stratum will be the warmest, the highest the least warm. The transition from the temperature of one stratum to that of the next will be gradual and regular. The changes of moisture and of density in the various strata will be gradual and not abrupt.

A ray of light from a star falling on such a series of strata will pass through them all in a regular smooth curve. In the telescope no twinkling of the star-image will be noticed.

Now if some of these strata are very cold, while the adjacent ones are warm, the atmosphere in such regions will be in rapid and irregu-

lar motion. The warm air below will be rising through the cold strata above and the air of the latter will be falling. These motions are necessarily irregular and complex. If a strong wind is blowing in these regions, the rapidity and complexity of the changes may be increased. A ray of star-light will pass through such a mixture in a zigzag line with a thousand small irregularities, and these will produce variations in the image seen by a telescope. Let us first consider the sidewise motions of the star-image. To the naked eye these may appear quite considerable. In the telescope they will be multiplied by the magnifying power used.

Beside the sidewise motion of the star-image produced as described, the motions of the layers of atmosphere give rise to other effects. They virtually change the focus of the observing telescope, as follows: The object-glass of the telescope is a lens which grasps parallel rays and brings them to a definite focus. The eyepiece is placed so as to see the image at the focus as sharply as possible. A change of a few thousandths of an inch in the position of the eyepiece may be fatal to good definition of the image. If we should suddenly change the object-glass of the telescope and replace it by another one of slightly different focus, say a few tenths or even hundredths of an inch different, leaving everything else the same, it is clear that accurate vision would be destroyed. A perfect image of the star would be formed in the focus of the new object-glass, but the eyepiece would no longer be in the correct position with reference to the new image, and the vision would be unsatisfactory.

An effect precisely similar to the sudden changing of object-glasses is frequently produced by the sudden changing of the curvature of the layers of air in front of the telescope. These layers, which were, let us say, at first horizontal, are suddenly bent by air currents so as to have a decided curvature and so that they act like lenses upon the incident star-light.

The ray from the star which at first came to the true focus of the glass-lens of the telescope is suddenly brought to a new focus, whose position is fixed by the combination of the air-lens, so to say, and of the glass-lens. Measures of the curvature of such atmospheric strata have been made, and their radii of curvature have been shown to be at least as small as 6600 feet. An air-lens of this curvature in front of the object glass of a large telescope will change the place of the image by several hundredths of an inch. The eyepiece, which remains at one place, can no longer give an accurate image, and the definition is thus spoiled.

The foregoing elementary explanation supposes the change of focus to take place with some regularity. In practice the changes are usually

very irregular, so that, for example, it would be quite impossible to alter the position of the eyepiece to a place suitable for seeing the new image.

The twinkling of stars also produces marked changes in their colors. A bright star, near the horizon, will show these changes to the naked eye. In the telescope, and especially in the spectroscope, they are very obvious, and at times quite fatal to measurements. They are all due to changes in the temperature and arrangement of the strata of the atmosphere, and are only absent when these strata are arranged concentrically in parallel layers.

The deformations of star-images and of star-spectra have been studied by Arago, Secchi, Dufour, Montigny, and others, to whose memoirs reference is made in passing. The object of the foregoing paragraphs is simply to describe the general effects of bad definition—bad seeing—due to inequality in the distribution of temperature in the atmospheric strata in the neighborhood of the observer. These effects are more apparent the larger the aperture of the telescope employed and the greater its focal length.

More bundles of rays, coming from more directions, fall upon a large object-glass than upon a small one. The changes in focal length due to "air-lenses" are expressed in per cent of the focal length itself, and hence the absolute displacement of the disturbed image, in inches, is greater when long telescopes are employed. It is for these reasons that it is especially necessary to select suitable sites for the emplacement of the large telescopes of modern times. The study of the conditions of seeing at mountain observatories thus becomes of capital importance.

In a general way it may be said that the air-strata over an extensive plain arrange themselves horizontally. On a mountain peak, however, they are necessarily curved, except when a complete calm prevails, and when, also, the temperature-conditions are the same for considerable distances above and below the peak, if the whole air is clear, or from a considerable distance above the peak down to the upper surface of an extensive fog-layer itself lying some distance below the summit. The last arrangement describes the usual summer conditions at night on Mt. Hamilton. A capital merit of our climate is that the vision usually continues good during the entire night if it is good at the beginning.

An important advantage to be sought for in the site of an astronomical observatory is the *continued* clear weather. Much time is spent in preparing for observations; and this is time lost if the observations are prevented by clouds or fogs. If one is sure of good weather, a programme of observation may be made weeks beforehand, and carried out to the letter at the appropriate time.

The observatory of Algiers probably has fewer clouds than any other. In 1883 the sun was photographed there on 310 days.*

Southern California, Egypt, Arabia, Madeira, Peru, parts of Australia, etc., have excellent records in this regard; not all of these regions are suitable for refined astronomical observations, however, as several of them fail in respect of the most important condition, namely, steadiness of the air.

The advantage of a suitable station for astronomical work can be strikingly illustrated by a comparison. Dr. Lewis Rutherfurd made hundreds and hundreds of negatives of the moon, only a few of which are of high excellence, the sole cause being the very unfavorable situation of his observatory in the city of New York. Dr. Henry Draper, in 1877, reported that only three nights in two years gave him good lunar photographs at his observatory at Hastings-on-the-Hudson, where the steadiness of the air was not satisfactory.

During August, 1888, photographs of the moon were made at Mt. Hamilton on the following dates. All the negatives were fairly good and those marked with a star were very good; with two stars, excellent: August 12*, 13*, 14**, 15**, 16, 17, 18, 19 (no observations—Sunday), 20, 21, 22, 23*, 24*, 25, 26*, 27*, 28*, 29 (no observations—the sky was clear), 30*, 31*.

All the nights were clear—nearly all were good—and at least two of them were superb.

Speaking broadly, and making every allowance for exceptions, it is true that, other things being equal, an astronomical station on an extended and elevated plain is preferable to one on a sharp peak. The conditions for level and tranquil arrangements of air-strata are more favorable in the former case.

In any case, it is desirable that the surroundings of an astronomical observatory should be uniform—homogeneous. The level verdant plains of Lombardy, the small coral islets of the tropics of the Pacific, are examples. A level extensive plain of snow is not, in itself, objectionable; but such plains are ordinarily found in regions affected by other conditions which are distinctly unfavorable.

High rocky peaks will usually have bad vision both night and day, owing to the heating of the rocks by day and to the air-currents (controlled by the topography) by night. In regions (like California) where the air is very dry, and where there is no great diurnal variation in temperature (as on the flanks of Mount Whitney, and elsewhere in the Sierras), the conditions for good vision are very frequently present. I should suppose, however, that they would vary very much

* *Publications of the Astronomical Society of the Pacific*, vol. IV, p. 268.

from one locality to another, though this does not seem to be the judgment of Professor Davidson, whose experience is very wide in this respect.

In the Rocky Mountains of Wyoming, Utah, and Colorado, speaking generally, and also at such stations as Mont Blanc, it would seem that excellent observing weather would be rare (especially in respect of steadiness).

It must be borne in mind that the uses (to astronomy) of high-level stations are, in general, not for consecutive and long-continued registration of phenomena, but rather for comparison between the results of special observations made simultaneously, or nearly so, at high and low levels. In most researches these corresponding series may be short, and do not require the expensive installation of a permanent observatory, but rather the equipment of a scientific camp, and this is especially true if suitable stations are selected.

It is also necessary to look at the question in a practical way.

The available endowment of astronomical research is, in fact, limited. Certain large subsidies are, and always will be, granted by governments and they may, in the future, be greatly increased. The generosity of individuals, like Lick, Boyden, Bischoffsheim, Draper, and others, seems unbounded; but there is a limit to this, as well.

The practical question to be decided is, how shall these endowments be best expended for the benefit of astronomy?

It is certain that, in future, no one will be justified in establishing an astronomical observatory of research in a site which has not previously been proved to be suitable.*

High-level meteorological observatories will always be needed, in spite of the fact that their records are necessarily much affected by merely local conditions. The improvement of self-registering instruments, running for long periods, will enable such establishments to dispense with a large staff of observers.†

The development of methods of observing by instruments in balloons

*The great apparent waste of money in the establishment of new observatories in the United States may be partly justified by the fact that most of them are attached to colleges, and are directly useful in training students in exact methods. Founders of such establishments will do well to recollect that comparatively small and inexpensive outfits will accomplish all the ends of a college observatory. Ten thousand dollars wisely expended is sufficient, and twenty thousand dollars will provide an observatory in which original work can be well done. The important point is to provide an endowment fund, to be used solely for scientific work, over and above the first cost of the establishment.

† M. T. de Bort (*American Meteorological Journal*, vol. VII, p. 319,) expresses the opinion that $1000 to $2000 will provide the outfit for a station of this sort, and that its annual expense need not be over $200. The site chosen will, of course, greatly modify these estimates.

and on kites will do away with the necessity for a great number of mountain stations. A given amount of money expended in securing such observations will, without doubt, produce the maximum of useful result.

It is important to remember that observatories on high mountains, as at Etna, must either be abandoned altogether during the winter season or, if occupied, the observer must be subjected to extremely trying conditions and to some danger from terrific storms of wind, snow, hail, from lightning, etc. The discomfort and monotony of such a life, subjected to very low temperatures and surrounded by clouds and snow for long periods, will unfit an ordinary individual for making the best use of the few clear days which an alpine winter presents.

Telephone and telegraph lines cannot be maintained in working order under such conditions without taking extraordinary precautions, and there must be days and weeks together when travel between the summit and the valley is shut off.*

Some of the material hindrances in the case of mountain-stations are:

1. The great expense of erecting suitable and safe buildings at such sites. The cost of building (M. Vallot's observatory) on the flanks of Mont Blanc was $74 per cubic metre.

2. The large cost of maintenance.

3. The difficulty in arranging for an adequate water-supply.

4. The great expense for freight. Transportation to the summit of Mont Blanc costs 2.50 francs per kilogramme, or about 23 cents per pound. Even at Mount Hamilton light parcels (food, etc.), delivered daily, cost 1 cent per pound; and heavy freight hauled from San José, as occasion serves, costs $8 per ton.

5 *Forest-Fires.*—Observers upon mountains in the United States frequently report that the smoke from distant forest-fires is a great hindrance to their work. The transparency and purity of the sky are greatly affected by the smoke from a large fire, even if it is quite distant. Such hindrances will continue to be felt until the United States and the several States adopt a rational system of forest conservation. The waste lands are occupied by sheep-herders, and fires are deliberately set by them so as to insure a better crop of grass for the next season. In more settled regions, as near Mount Hamilton, forest-fires are usually the result of carelessness and accident, but they are frequent.

6. *Snow-Blindness.*—Snow-blindness is a severe and sudden attack of inflammation of the eyes. A few hours' use of the unprotected eyes

* Even on Mount Hamilton we have been without any communication with the valley for a week, and without stage communication for three weeks. And Mount Hamilton winters are a *bagatelle* to the summers of Mont Blanc.

may bring it on. The application of suitable lotions will cure the actual blindness in a day or so, but the eyes remain tender and weak for long periods after a bad attack, for weeks or even months. It is necessary to wear tinted spectacles if one wishes to avoid this painful and troublesome experience. This is an inconvenience connected with life at high altitudes which cannot be avoided except by special precautions.

7. *Mountain-Sickness.*—Considerations on the so-called "mountain-sickness" will be found in various places throughout this paper, in connection with narratives of residence or adventure at high stations (see the sections on Whymper's travels in the Andes, the Harvard College stations in South America, Mont Blanc, etc.).

It may be noted here that some two-thirds of the tourists who come (by train in $1\frac{3}{4}$ hours) from the level of Manitou (6563 feet) to the summit station of Pike's Peak (14,115 feet) are affected by the altitude, though they have made no physical exertion whatever.

Some of the cases are serious. Certain persons are not able to remain on the summit at all.

Mountain-Sickness on the Jungfrau.—The following item was found in California papers early in 1895:

> The proposed railway to the top of the Jungfrau, which is 13,671 feet high, has made it desirable to determine the effect upon employees and passengers of travel to so elevated a station. M. H. Kronecker, who has conducted the investigation, concludes that mountain-sickness sets in at altitudes varying with different persons. Beyond 10,000 feet it attacks all persons on the slightest muscular exertion, but children and very old people are much less subject to it than others. It varies with the character of the mountains, being usually less serious on isolated peaks. Persons in good health can stand passive transport to the height of the Jungfrau without inconvenience, but they should not remain more than two or three hours, as a prolonged stay might prove disastrous. Workmen should be carefully selected, and, if possible, acclimatized or frequently changed between stations; and the summit station should be so arranged that full benefit of the view may be had without effort.

If these statements are correct, it would seem that the *change* of barometric pressure, rather than the absolute pressure, is the immediate cause of mountain-sickness. In Switzerland, persons going from a low level, Interlachen, 1900 feet, up to 10,000 feet are said to be affected. It is rarely felt in the Rocky Mountains under 14,000 feet; but here the traveller has previously been living at an altitude of say 6000 feet. In the Andes, where the mountains often rise from high plains, the sickness seems to be first felt at about 16,000 feet, say 8000 feet above the lower stations.

I am informed by those who have lived among the Indians of the high Sierras of Chile that they are entirely exempt from mountain-sickness, and, in fact, that they do not appear to experience any inconvenience whatever from the thin air of great elevations. It is very noticeable that their chests and the upper part of their bodies are disproportionately large, and their lung-capacity far greater than ordinary. Europeans do not, however, acquire immunity by long residence.

8. Finally, the physical condition of persons living at high altitudes is best described in the words of M. Vallot as "diminished living." De Saussure says of his experiences on Mont Blanc that at the summit he could not accomplish in four and a half hours the work he had been used to do in less than three hours at the base. This is a kind of numerical measure of the falling off of ability.

A long experience in such residence or in mountaineering habituates one to the new conditions more or less, and the "living" is "diminished" in a less degree. The effect remains, however, and must be reckoned with in arranging for the occupation of high stations.

Devoted men can always be found to undergo necessary hardships in the pursuit of scientific truth. If the scientific results do not justify the exposure, we no longer admire the effort as devotion, but blame it as foolhardiness.

Following this introduction is a series of chapters dealing with the high-level meteorological and astronomical observatories of Europe, North America, and South America. In these chapters the subjects treated in the introduction in a general manner are again considered, more minutely, in connection with the particular conditions which subsist at the different stations. The main scientific and practical conclusions to be drawn from the facts here brought together are very plain and obvious.

Briefly they show the necessity for a careful examination of the sites proposed for an astronomical, or meteorological, observatory before a final choice is made. They prove that while some mountain-stations present great advantages for astronomical and astrophysical observatories this is by no means the case for all. And they point out that the more frequent use of balloons, etc., in meteorology is likely to result in a rapid advance in our knowledge of the physics of the atmosphere, and to do away, in a great degree, with the need for permanent meteorological stations at high levels.

It appears that different researches require different conditions. All would be best done at a station where both steadiness and transparency were absolute. But some can be very well performed under

less perfect conditions, If one is searching for the site for a new observatory, both conditions should be insisted upon; if one is planning work at a station already established, the work should be chosen so that it can be well done under existing conditions.

None of these and other obvious conclusions are new. The mass of evidence will, however, bring new conviction even to those most familiar with it; and it may serve as a check on the wasteful expenditure of public and private endowments. The subsidies to science, great as they are, thanks to the generosity of governments and of individuals, must be carefully husbanded if we are to exploit its entire domain, which is enlarging day by day, one may say moment by moment.

CHAPTER I.—THE OBSERVATORIES OF EUROPE.

THE TENERIFFE EXPERIMENT (1856).

Professor C. Piazzi-Smyth, late Royal Astronomer for Scotland, deserves the lasting gratitude of practical astronomers for his undertaking of the Teneriffe experiment in the year 1856. The question of "how much astronomical observation can be benefited by eliminating the lower part of the atmosphere" was for the first time plainly put and partially solved. In two works, one the scientific report of his expedition to the Royal Society of London,* the other more popular, † the question was stated in the plainest manner, and a partial conclusion was reached. I refer to the original works, just cited, for the history of the idea, which appears to have been entirely original with Professor Smyth, and only remark in passing that the expedition to Teneriffe was undertaken by the aid of a government grant, with the benefit of the advice of several distinguished astronomers, among them Sir George Airy and Sir John Herschel, and that it was greatly aided by Robert Stephenson, the Engineer of the Britannia Tubular Bridge. So much should be said in even the shortest notice of the expedition.

The summer of 1856 was spent at Teneriffe, and the instruments were set up at two stations, Guajara (8903 feet) and Alta Vista (10,702 feet). The summit (12,198 feet) was also visited. A little over two months was devoted to the work. A telescope of 7¼ inches in aperture was employed. The conclusions of Professor Smyth were briefly as follows:

With increased altitude (comparison of Teneriffe with Edinburgh) the *transparency* of the air was much improved (as was expected); and its *steadiness* also. (Teneriffe is a small island in the trade-wind belt, and the surrounding ocean should tend to equalize temperature and to produce *good definition.*)

The definition appeared to be equally good over all parts of the sky, and for the whole night, except shortly after sunset. During the daytime "the sun was seldom well defined." The blueness of the sky, even at the highest station, was in no wise remarkable. A "glare,"

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* *Philosophical Transactions*, vol. CXLVIII, 1858, p. 465.

† *Teneriffe,—An Astronomer's Experiment.*

produced by reflection from dust particles, appears to have been generally present.

A very interesting observation of Professor Smyth may be mentioned in passing. Teneriffe is a volcanic island, and its craters were a living model of corresponding formations in the moon, even to small details of structure. (The same is true of Hawaii.)

Professor Smyth refers to the uncommon dryness of the air at the high stations as an "agent in producing good definition." The upper air was usually dry, and very frequently strata of clouds hung on the skirts of the mountain far below him. I am strongly inclined to believe that these clouds materially aided good definition by confining heat-waves from the mountain and sea from rising above them. Our best nights at Mount Hamilton appear to be those where mists and fogs cover the valley beneath us.

The steadiness of the stars to the naked eye was frequently remarked upon. They did not seem to twinkle, at first sight, though a careful view showed that they did so. This simple observation is the best evidence of the excellence of the observing-station.

The high *winds* in the trade-wind belt were felt as a practical inconvenience. Their effect upon the "seeing" is not mentioned by Professor Smyth. It cannot be favorable, in general, at mountain-stations, where the air in windy weather can never arrange itself in approximately horizontal strata. On extensive plains and at sea the effect of high winds on the seeing is, on the whole, good, according to my personal observation.

The *dust-haze* was ever more or less present, though sometimes in vastly greater quantities than at others. The "glare" near the sun was directly due to this. It lay in horizontal banks. An observer at the level of the sea would be more incommoded by such a bank than one at a higher station if he were looking nearly vertically. But it might be different for a nearly horizontal view if the higher station lay in the plane of the bank. A sharp rain will always settle such dust-banks, but at Mount Hamilton it almost always leaves the air unsteady.

The transparency of the air was extremely favorable for certain physical observations, as of the zodiacal light, solar radiation measures, spectroscopic and polariscopic observations, etc. It is, in fact, obvious that the mere avoidance of the lower strata of the atmosphere must be of the highest value in certain work of this kind, and that any mountain observatory will have *certain* advantages. Definition is important to the astronomer, but there are many physical problems in which it plays no part. All these points, which are simple, were first brought out in a clear and definite fashion by this expedition. Teneriffe may be regarded as the parent of every mountain observatory.

THE ASTRONOMICAL OBSERVATORY ON ETNA (9652 FEET).

The observatory on Etna was first proposed by Professor Tacchini, in June, 1871, although his idea was not realized till 1881. As at present organized, it is an annex of the observatory of Catania. The 35 *cm.* (13.8-inch,) equatorial of the two observatories has a single object-glass and two mountings, one at each station. During the favorable season, July to October, the lens is mounted at the summit, while it is employed at Catania for the remainder of the year. The Etna station is reached by a drive of about eleven miles over a carriage road to Nicolosi, and from thence on horseback in six hours, provided the trail is not obstructed by snow.

Several important series of observations, having for their object the determination of the relative advantages of high-and low-level observing stations, have been carried out on Etna by Tacchini, Langley, Hale, Ricco, and others. They need not be referred to in detail here. The detailed report of Professor Hale and the general conclusions of Professor Tacchini, which follow, seem to give all the information of special value for our immediate purpose.

Professor G. E. Hale spent some time on Etna in 1894 in an attempt to photograph the solar corona in full sunshine. His notes on the purity of the sky show that the blueness of the sky increased slightly from 1450 metres (4757 feet) up to the summit. The stars were unsteady even at the zenith (July 8).

On July 9 the sky was clear. A strong wind was blowing the smoke from the great crater (which rose behind the observatory to an altitude of 3312 *m.*, 10,866 feet) away from the direction of the sun. Half the island of Sicily was dimly visible through a great brown bank of thick haze, the upper surface of which seemed to be nearly on a level with us. The sun was seen (between clouds) to be surrounded with a bright halo. In the afternoon the sky became much whiter.

On July 10 the wind blew the smoke of the great crater over the sun, making the sky very white. The image of the sun was rather better than at Catania, but it became unsteady later. At 10 h. the sun was surrounded by a white halo, and clouds of insects were noticed as at Pike's Peak in 1893.

July 11. The sky was very white with a bright ring around the sun. The seeing was excellent.

July 12. The sky was very white, and there was a bank of haze above the level of the observatory. The smoke from the crater was blown over the sun. The sky seen from the summit of the great crater was bluer than when seen from the observatory. The whole island was enveloped in haze. The seeing (at night) on the moon, *Saturn*, and stars was magnificent. The images were almost perfectly steady with the highest power. With the naked eye the twinkling of the stars was hardly perceptible in stars higher than 30°.

July 13. Sky cloudless and generally whitish, but the best seen since July 9. Much dust. The definition on the sun was poor.

July 14. The whole eastern sky was white. Left the observatory this day.

These notes of Professor Hale's seem to show that the smoke from

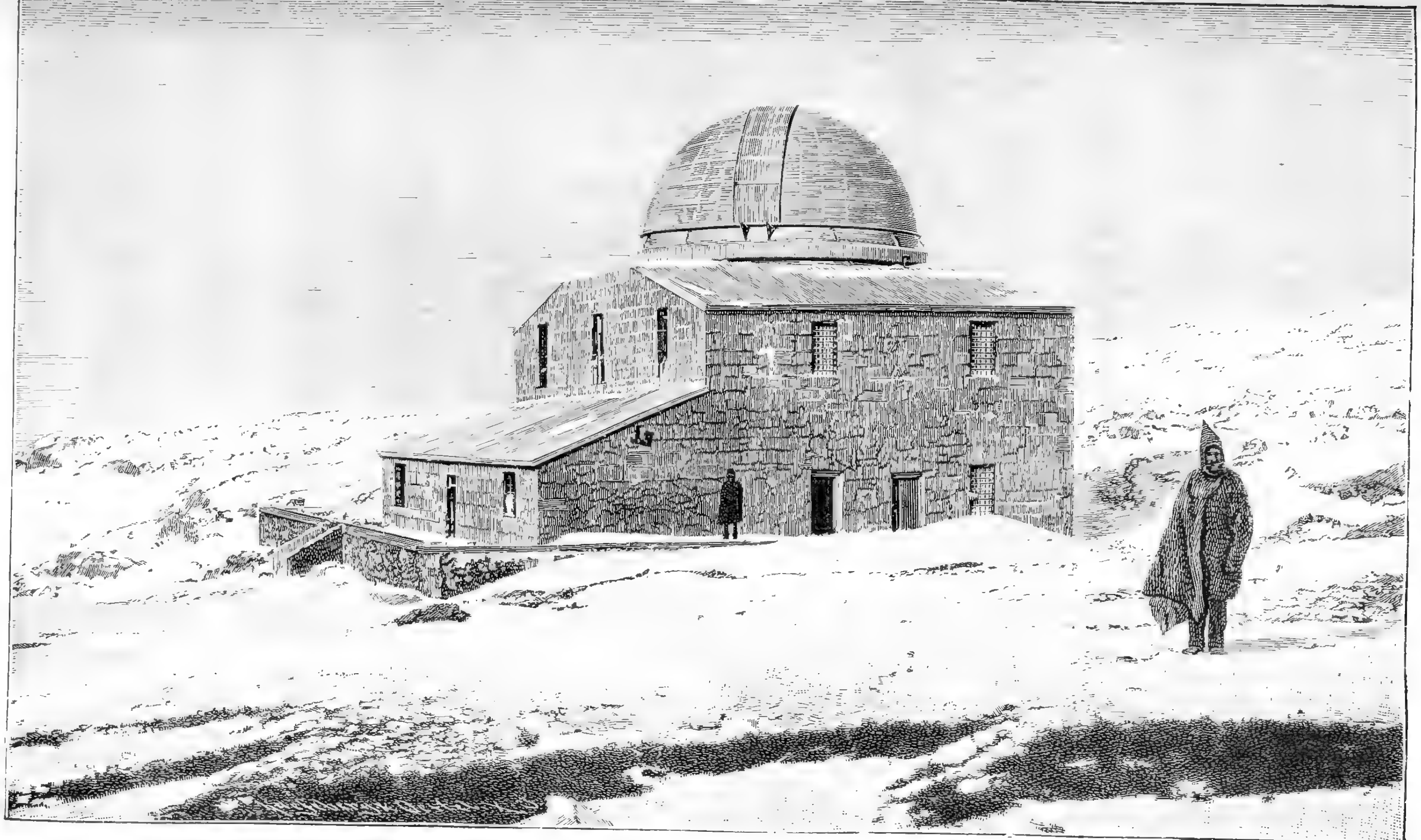

FIGURE 1:—THE ASTRONOMICAL OBSERVATORY ON THE SUMMIT OF ETNA, (9,652 feet).

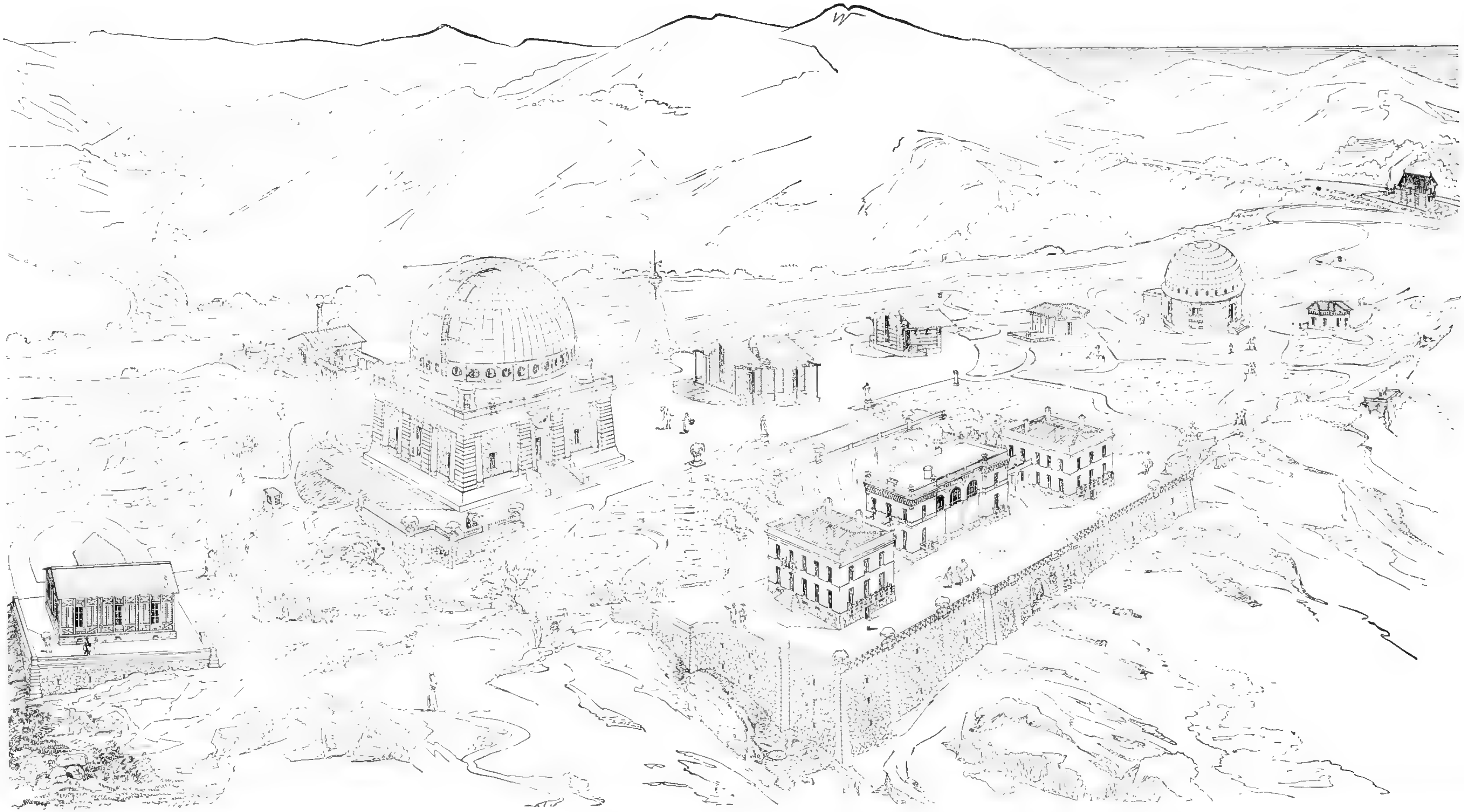

FIGURE 2.—THE ASTRONOMICAL OBSERVATORY OF NICE, (1,100 feet).

the crater produces a whitish sky, as is *a priori* probable. On one occasion the definition was of high quality. It is Professor Hale's opinion that the sky at Pike's Peak is considerably more pure; and this, again, is *a priori* likely to be the case. The forest-fires and the dust from the plains to the east and from the South Park to the west would seem to be the chief sources of solid particles in the surrounding air, and all these taken together are not likely to produce as much effect on the transparency of the sky as the smoke from Etna's crater.

The favorable season on Etna is comparatively short, from the middle of July till early October. The mean temperature of July at Casa Inglese (about 9600 feet above sea) is about + 5° C. (41°.0 F.), the highest is about + 13° C. (55°.4 F.), and the lowest about — 1° C. (30°.2 F.).

I have applied to my friend Professor Tacchini for his judgment of the astronomical conditions on the summit of Etna, and the paragraph which follows is extracted from his reply, dated January 23, 1896, to my letter of inquiry. This verdict must be accepted as entirely authoritative in all respects.

"Quant à mon opinion sur les questions posées par vous, voilà ma rèponse :

1°. The sky is certainly markedly purer and more translucent on Etna than at the sea-level.

2°. The stars are markedly more steady on Etna than lower down.

Mais, comme vous dites, suelement dans les meilleures conditions d'observation, qui, dans les observatoires très-élevés, ne sont pas aussi fréquentes comme on peut le croire."

The Astronomical Observatory of Nice

(ON MOUNT GROS, 1100 FEET ABOVE SEA).

The observers at Nice have been too much occupied with making valuable observations and discoveries to devote any considerable amount of attention to investigating the conditions of the atmosphere on Mount Gros, but their published volumes enable us to give a rough estimate of the steadiness of the atmosphere there. In the double-star measures of M. Perrotin with the 15-inch telescope, magnifying powers of about 1000 diameters were habitually used. Each measure of a star was marked *a*, *b*, *c*, according as the images were *good*, *pretty-good*, or *moderately-good*.

I have had the curiosity to count the number of times each letter occurs, as follows:

a	occurs	477	times,	from June, 1883, to August, 1886.
b	"	1282	"	
c	"	197	"	
	Total,	1956	"	

When the images were of class *c* it is obvious that few measures would be made. It is not necessary nor perhaps practicable, to deduce a numerical estimate of the average observing weather at Nice during this period for comparision with that at other observatories. It is obvious that the conditions are excellent, and distinctly better than at most observing stations.

Under good circumstances the transparency and purity of the sky at Nice are remarkable. If the disc of the sun be hidden by a screen there is no "glare" in the field even close to the point of tangency. For a time this transparency was lost, during the time of the Krakatoa eruption and the red sunsets, but it appears to be the normal condition. M. Thollon remarks (vol. II, p. E. 23) that the great comet of 1882 was seen by day from Mont Gros.

Mont Mounier (8993 feet).

The observatory of Nice, which was built by the gifts of M. Bischoffsheim, has an annex on the summit of the mountain *le Mounier*, 2741 metres (8993 feet) in altitude. The annex consists of a stone cottage for lodging the observer and his assistant, a metallic dome some 24 feet in diameter, covering an equatorial telescope of 38 *cm.* (15 inches) aperture, and a wooden store-house. The station is equipped not only for astronomical observations, but for meteorological as well; and it is connected by telephone with the neighboring village of Beuil. M. Perrotin describes the astronomical conditions as of the best.

Proposed Observatory on Mont Meige (Alpes dauphinoises) (13,000 feet).

It is proposed (December, 1894) to erect an observatory upon this high peak. I have no further information regarding it than the mere announcement.

Observatories, etc., on Mont Blanc (15,780 feet).

This is not the place to give even a *résumé* of the interesting history of Mont Blanc. It is necessary to confine this section to a bare recital of the main facts which bear on the question of its suitability for astronomical and meteorological stations.

So far back as 1760 the naturalist De Saussure offered a prize for the discovery of a practical route to the summit (15,780 feet), but it was not until 1786 that such a route was found by Balmat, the guide (and the ancestor of a family of guides).

In the next year De Saussure himself made the ascent and spent several weeks on the flanks of the mountain. Since that time many

FIGURE 3:—ON THE WAY TO THE MONT-BLANC OBSERVATORY.

ascents have been made, but none of them without difficulty and danger. A glance at the accompanying illustrations is instructive.

Mountain-sickness has been experienced on Mont Blanc by the great majority of climbers from the time of De Saussure until now. De Saussure found his powers of work much diminished. His words are: "Je ne pus faire dans ces quatre heures et demie toutes les expériences que j'ai fréquemment achevées en moins de trois heures au bord de la mer." Here we have something like a numerical estimate of the loss of physical vigor.

Such questions will soon receive a definite solution from the experiences of observers in actual residence on the summit.

The establishment of a meteorological observatory on the Pic-du-Midi and of stations at the Théodule pass (3300 metres) and on the Sonnblick (3100 metres), of late years, suggested to Monsieur J. Vallot of the French Alpine Club, that a station on Mont Blanc might be practicable and useful. In 1887 a party of thirty guides transported to the summit a tent and sufficient material to allow M. Vallot and three other persons to remain three days.

M. Vallot recognized the great difficulties to be overcome in establishing a station at the very summit, and therefore determined to erect a permanent meteorological station at the Rochers des Bosses (4365 metres, 14,321 feet).

It is M. Vallot's opinion that this station is preferable for meteorological purposes to one at the summit; and it is certainly far more accessible. M. Vallot's observatory was erected in 1890. In the same year, M. Janssen proposed to build an observatory at the very summit, and as a preliminary step did erect an observatory station at the Grands-Mulets (3000 metres, 9843 feet). The observatory of M. Vallot was erected at his own expense. The various stations constructed under the direction of M. Janssen have been built from a fund provided by subscription, and are, I believe, annexes of the Government Physical Observatory of Meudon, near Paris. Both these establishments pursue the most liberal policy towards scientific observers, and open their doors to any investigator; in fact, even to tourists and mountain climbers. M. Janssen's observations on the presence of oxygen in the atmosphere in 1891 were made from M. Vallot's observatory, and M. Janssen's establishment on the summit is to be international in character. This is certainly as it should be.

M. Janssen's Expedition to the Summit of Mont Blanc (1890).*

The original account of M. Janssen's scientific expedition to the summit of Mont Blanc is printed in the *Comptes Rendus* of the Paris Academy of Sciences,

* From the *Publications of the Astronomical Society of the Pacific*, vol. III., p. 50.

vol. CXI (1890). The following is a brief abstract. The object of the expedition was to determine whether oxygen exists in the solar atmosphere. When the solar spectrum is examined with a spectroscope, at sea-level, some lines are seen which may be due to oxygen in the sun's atmosphere, or which may be due to absorption effects in our own terrestrial air. If the spectrum is examined from terrestrial stations of great elevation, the absorptive effect of the earth's atmosphere is less and less, as the station chosen is higher and higher, naturally. In October, 1888, M. Janssen made the ascent of Mt. Blanc as far as the *Grands-Mulets* (about 9800 feet above the sea), and obtained satisfactory observations; in 1890 he ascended to the very summit of the mountain (15,780) feet, and repeated his work. The immediate scientific result of his two expeditions is that oxygen is not present in the gaseous envelopes which surround the sun; or, at least, if oxygen is present, it is in a condition entirely different from that known to us in our laboratories, and does not produce that absorption of light which is marked by the system of lines and bands familiar to spectroscopists.

This is a scientific conclusion of capital importance in questions of solar physics. It has been confirmed by later observations by the same observer on the summit of Mt. Blanc (1895).

The expedition of M. Janssen has an interest quite apart from its purely astronomical one. In fact M. Janssen lays the chief stress, in the paper cited, upon the question of the establishment of a high-level observatory at the top of the mountain, and points out the great scientific advantages to be gained from such an observatory devoted to questions of terrestrial as well as of solar physics. If such an observatory is to be founded anywhere it is tolerably certain that stations can be found which are far more favorable than Mt. Blanc. Pike's Peak, for example, is 14,134 feet high, and the summit can now be reached by a railway. There is no reason why a station on Pike's Peak could not be maintained throughout the year, since the U. S. Signal Service kept its observers there for several years continuously. There are also many stations in the Sierra Nevada of California which have natural advantages far above those of Pike's Peak. It would seem, then, that for scientific purposes alone, it might be better to maintain a station at one of these places (to speak only of mountains in North America), than to attempt to found such a station on the summit of Mt. Blanc, which can be reached only with great difficulty and some danger under the most favorable conditions, and which is practically inaccessible during many months of the year.

The chief interest in M. Janssen's paper, after its astronomical importance, is, for us, the exhibition of his intrepidity in planning such an ascent at all, and of his cool daring in accomplishing it. M. Janssen is sixty-six years of age, and suffers from a severe lameness, so that it is practically impossible for him to make continued exertion in walking. During his ascent to the *Grands-Mulets* in 1888 it was with the greatest difficulty and danger that he attained the cabin at that point, although the ascent is by no means difficult for good walkers. Many ladies, for example, go as far as this. How then was it possible for him to reach the summit, 6000 feet higher, which lies beyond a wilderness of huge rocks and great glaciers with their crevasses, and the route to which runs along steep *arêtes* only two or three feet wide, with terrific slopes on both sides of the narrow crests? To appreciate the splendid daring of M. Janssen, it is necessary to read his own words. It is only possible here to give the merest summary of them.

Before leaving Meudon, M. Janssen had a sled constructed which resembled in general pattern the reindeer sledge of the Laplanders. In front and behind this were double parallel cords, united by wooden rungs like ladders. A long line was attached to the front of the sled, and another to the rear. The ascent was made as follows: M. Janssen was seated in the sled, and twelve selected guides managed its movements. Two guides, far in advance, sunk an ice-axe in the snow as far

FIGURE 4:—ON THE WAY TO THE MONT-BLANC OBSERVATORY.

FIGURE 5:—ON THE WAY TO THE MONT-BLANC OBSERVATORY—(The Refuge at Grands Mulets).

as it would go and kept two turns of the forward line wound round its handle. When necessary the other line was kept tight also. The remaining guides pulled on the rope ladders front and back, or, when possible, supported the sled at the sides. In this way, foot by foot, the sled was moved. It was necessary for the guides to cut steps in the steep slopes for their feet to rest in. All that the passenger was required to do was to sit still and keep perfectly cool. This was all—but in the face of the frightful precipices with which the route is surrounded, it was enough.

There are few men whose nerves are steady enough to contemplate dangers of the sort when they are themselves precluded from some sort of physical action. I pass by all the incidents of the route; the passage of the well-known obstacles; the two days and a half spent in a small cabin at the station *des Bosses* during the prevalence of a hurricane; the ascent of the final slope; and simply recite that the summit was reached during weather exceedingly suited to the observations, and that the descent (which was more dangerous than the ascent) was safely accomplished. The party had been five days on the mountain.

M. Janssen says that he is perhaps the only person who has stood on the summit of Mt. Blanc without having made severe exertions to reach it, and who, therefore, was completely possessed of his intellectual vigor, which is always diminished after bodily toil. He makes no account of the nervous strain of the ascent, or of the anticipation of the far more dangerous descent, and this strain would be a more severe tax on the faculties of most persons than even violent and continued exertions. Those who remember M. Janssen's cool ride *on horseback* over the crater-floor of *Kilauea*, in 1883,* can understand that the danger of Mt. Blanc might seem a little thing to him; but it is difficult to think that his plan for a physical observatory among those perils is a practical one. It is permissible to admire his courage and devotion, and yet, in the name of Science, to suggest that the dangerous summit of Mt. Blanc be abandoned for such a purpose, and that the proposed observatory be established on Pike's Peak, only a few hundreds of feet lower, at the end of a railway and telegraph line already in operation, and in a situation where it is perfectly practicable to maintain observers during the entire year, with few difficulties and with no peril; or, if not at Pike's Peak, then at some station less dangerous than Mt. Blanc. Of M. Janssen's expedition and of his project we may be permitted to say, with the fullest admiration for his courage and for his successes, but with a recollection of the limitations of ordinary men—

"C'est magnifique, mais ce n'est pas la guerre."

M. Vallot's observatory is primarily devoted to meteorology and to observations of a physiological nature upon mountain-sickness and the effect of great heights upon the human frame. Vallot sums up his own experiences as follows: "Life at very high altitudes is not, like the living of a diseased person, the result of a disordered circulation, but it is rather a *diminished-living*, due to insufficient supply of oxygen."

The inhalation of pure oxygen appears to be, in some slight measure, a remedy for the effects of exertion at high altitudes.

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* Very likely this particular escapade of the venerable astronomer is unknown in Europe, though it is well remembered in Hawaii, and serves as a companion-piece to his escape from Paris in a balloon, during the Franco-Prussian war, in order that he might go to India to observe the eclipse of 1871.

M. Janssen has also made experiments on these physiological points. During his ascent of 1890 (just described) he was dragged to the summit on a sledge by guides without physical fatigue on his part, and he describes himself as entirely free from any ill effects due to the height.* *Exertion* at high levels seems to bring on mountain-sickness, however, unless one is habituated to them by long use, as Mr. Whymper's Andes experiments prove; and M. Vallot's expression of "diminished-living" must be true, in general, of those who have work to do at high altitudes—witness the guides and porters of the Mt. Blanc expeditions, to mention no others. The hundreds of visitors to Pike's Peak are subjected to no fatigue during their ascent in the railway train; but "two-thirds" of them are subject to mountain-sickness in spite of the absence of fatigue.

The main work of M. Janssen's stations is to be in the fields of astronomy, physics, and meteorology, although other researches are to be undertaken.

Stations on and near Mt. Blanc.

	metres.		feet.
Observatory at the summit (Janssen) (astronomical, physical, meteorological,)	4810	=	15781
Chalet at the Rocher-Rouge (Janssen)	4509	=	14793
Meteorological observatory at Rochers des Bosses (Vallot)	4365	=	14321
Chalet station of the French Alpine Club / Cabin of the Grands-Mulets	3000	=	9843
Physical laboratory, etc., at Chamounix (Janssen)	1035	=	3396

The altitudes of other points on Mt. Blanc, are:

Rocher de la Tourette	4751 metres.
Rocher de la Tournette	4672 "
Petits-Mulets	4671 "
Petits Rochers-Rouges	4581 "

For comparison we may recall the altitudes following:

Geneva	407*m.* = 1315 feet
Grand St. Bernard	2477*m.* = 8127 feet

TABLE SHOWING THE WORK ON MT. BLANC FOR THE PAST TEN YEARS.

1886. M. Vallot made two ascents of Mt. Blanc.
1887. M. Vallot spent three days on Mt. Blanc.
1887. M. Vallot maintained self-registering meteorological instruments at Chamounix, Grands-Mulets, Mt. Blanc.
1888. M. Vallot made two ascents of Mt. Blanc.

* Pourquoi les émotions sont-elles alors si vives? pourquoi en particulier . . . éprouvai-je un sentiment de légèreté délicieuse dans tout mon être? pourquoi me semblait-il que j'étais soulagé d'un poids considérable qui avait jusque-là enchaîné et alourdi *ma pensée*, et que maintenant elle allait prendre son essor et aborder en toute liberté et amour les questions les plus difficiles et les plus belles d'un ordre moral supérieur? (*L'Astronomie*, 1893, p. 447.)

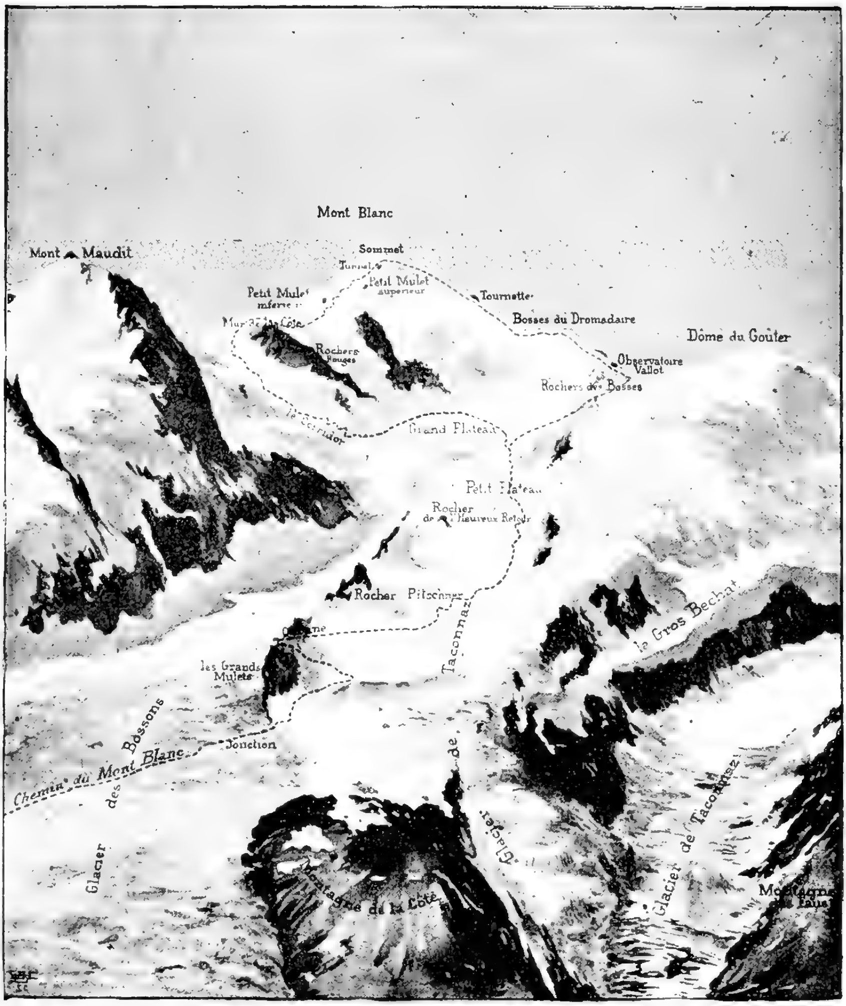

FIGURE 6:—VIEW OF MONT-BLANC, TAKEN FROM THE *BRÉVENT.*

FIGURE 7:—ON THE WAY TO THE MONT-BLANC OBSERVATORY—(Passage of a Crevasse).

1888. M. Janssen made spectroscopic observations on oxygen in the atmosphere at Grand-Mulets. (3000 *m.*)
1889. M. Vallot builds his observatory in Chamounix ready to be moved to the mountain.
1890. M. Vallot transports his observatory to Rochers des Bosses.
1890. M. Janssen proposes his observatory at the summit.
1890. M. Janssen makes a second series of observations on the presence of oxygen in the atmosphere, and ascends to the summit.
1891. The French Alpine Club places its observatory at Grands-Mulets.
1891. M. Janssen runs experimental tunnels in the snow at the summit, and places a small observatory there.
1892. M. Janssen constructs the observatory for the summit at Meudon.
1892. M. Janssen erects the Chalet at Rochers-Rouges.
1893. M. Janssen erects the observatory building at the summit (Sept. 8, 1893).
1894. Unfavorable season.
1895. The 12-inch equatorial carried to the summit and stored there. M. Janssen makes observations on oxygen in the sun at the summit.

Before erecting an observatory on the summit it was necessary for M. Janssen to know what sort of foundations his observatory was to rest on, and tunnels were run about 36 feet below the top surface of the snow at the summit without meeting rock. The temperature of the snow in these tunnels is nearly constant and about $-16°$C. $= +3°.2$ F.

The top of the mountain is, in fact, a glacier, and at times a *crevasse* has existed in the glacier near the summit. As no rock-foundations were available, M. Janssen determined to build his observatory on compressed snow, and to provide it with jack-screws in order that it may be levelled if necessary. The base of the structure is 10×5 metres and the snow always covers the lower story. It is intended to have the upper story in the free air, and to mount a telescope in an aluminium dome above the upper story. The construction is very solid and strong, with double walls and floors, and no pains have been spared to make it safe and rigid.

WEATHER ON MT. BLANC.

During August, 1891, a party of guides and workmen were employed in running the experimental tunnels at the summit of Mt. Blanc. An abstract of the meteorological diary is instructive. It should be compared with Professor Hale's diary on Pike's Peak.

15 August—work begun;

16 August—snow-storm; no work possible;

17 August—working;

18 August—working;

19 August—very heavy wind, no work; men go for provisions to Grands-Mulets.

20 August—very heavy wind, no work;

21 August—very heavy snow-storm; a tourist and a guide are killed by an avalanche;

22 August—violent storm;

23 August—snow-storm;

24 August—snow-storm;

25, 26, 27 August—the party goes to Chamounix for more workmen;

28 August—bad weather; no work done;

29, 30 August—working;

31 August—hurricane of snow; no work;

1 September—fine day; working;

2 September—working; Dr. Jacottet dies on the summit;

3 September—descent to Chamounix.

This, it must be remembered, is summer weather. The minimum temperature on the summit of Mt. Blanc during the winter of 1894 was $-43° C = -45°.4 F$.

The cost of buildings at these heights is very great. Ordinary laborers are paid 20 francs per diem when they are working near the summit, and 15 francs at the lower stations. The price for transporting one kilogramme to the summit is about 2.50 francs, or about 23 cents per pound. The ordinary load for a porter is about 12 to 15 kilogrammes (26-33 pounds), though some of M. Janssen's men carried from 28-30 kilos. (62-73 pounds). It is reported that the work on the observatories and stations built by M. Janssen has cost about $60,000, though this figure may not be correct. The building of M. Vallot erected in place cost about $9000, or about $74 per cubic metre.

The weather during the summer of 1894 was very unfavorable on the summit and the work was much interfered with. M. Janssen has devised an instrument (showing the records of a mercurial barometer, of the thermometer, hygrometer, and of the velocity and direction of the wind,) which is self-registering, and which will run for several months with one winding. This instrument is now ready for use. The difficulty of thickening oil in the works is overcome, but it does not appear how the traces of the different records (in ink? pencil?) are to be made. Even the best pens, etc., require frequent attention, especially at low temperatures.

In notes printed in the *Comptes Rendus* of September 2 and October 7, 1895,* M. Janssen describes the work of the observatory during 1895. The first communication is dated August 31, and reports that M. Bigourdan has determined the force of gravity at Chamounix and at the Grands-Mulets (3050 metres). The determination at the sum-

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* And in the *Annuaire* of the Bureau of Longitudes for 1896, p. D 1.

IGURE 8:—M. JANSSEN'S OBSERVATORY AT THE SUMMIT OF MONT-BLANC. (15, 780 feet).

mit is reserved for 1896. The season was not favorable, and M. Janssen congratulates M. Bigourdan on the courage, activity, and devotion which he showed in the "rude campaign." Dr. de Thierry had also made a "difficult and courageous" ascent to the summit, where he stayed for an entire day, engaged in experiments on atmospheric ozone and on microbiology. Thanks to the courage, the force, and the experience of the porters, all the parts of the 12-inch equatorial which is to be installed at the summit have been transported amid "the chaos of the glacier" and stored in safety without an accident to the men.

Leaving Chamounix on September 26, M. Janssen himself made an ascent to the summit to engage in observations on the presence of water-vapor in the sun (which he found to be absent, all the conditions being favorable for his spectroscopic work,) to examine the storage of the parts of the equatorial, and to inspect the self-registering meteorological instrument (which had ceased to act because of lack of stability, and was corrected).

M. Janssen examined the observatory also, to determine whether it had suffered displacement since its installation. It has moved slightly towards Chamounix, but this movement took place in 1893–94. The construction can be levelled at any time by the jack-screws with which it is provided. The problem of building on the summits of high mountains is then in a good way of solution, and M. Janssen points out that the high and snowy summits of the Andes, Himalaya, etc., "actuellement si importantes pour les progrès de la Météorologie et de l'Astronomie," are open to occupation so soon as we have learned to place buildings and instruments upon them which are appropriate to the conditions to which they will be subjected. In a foot-note M. Janssen recalls the fact that in 1891 M. Vallot pointed out that the summit of Mt. Blanc was a true glacier, and that such a site for an observatory should be rejected. The whole history of the Mt. Blanc station is not yet written, and it is at least possible that the very ingenious arrangements for the foundations of the summit station, which are entirely satisfactory at present, may need modification at a future time, under changed conditions. The summits of high mountains are certainly liable to serious changes, as many observations have abundantly proved.

In a note of 1890, Professor Cornu describes observations made by Dr. Simony in 1888 on the peak of Teneriffe, which had for their object the registration of the solar spectrum by photography, and which have a bearing on observations to be made on Mt. Blanc. It is of importance to know what the limits of the solar spectrum are, and, on the other hand, the observation of these limits at different altitudes constitutes

an excellent test of the purity of the sky at great altitudes, and gives a numerical measure of it.

From Professor Cornu's Alpine observations made in 1879, the result was that an elevation of 868 metres (2848 feet) increased the upper limit of the solar photographic spectrum by one unit of Angström's scale (*i. e.*, by one millionth of 1 *mm.*). The observations of Dr. Simony were made at two stations on Teneriffe, at Alta-Vista (10,702 feet), and at the summit (12,198 feet). Professor Cornu's map made at Courtenay (170 metres, 558 feet, above sea) served as a basis of comparison, and the comparison showed that the gain at Teneriffe in 1888 was substantially the same as that obtained in the earlier Alpine observations. Professor Cornu's conclusion is "that very little is to be gained [in this particular research] by transporting a spectrograph to high mountain stations; the amount of the gain appears to be less and less as greater elevations are reached." In spite of the small benefit, the great interest which attaches to the subject makes it very desirable that these experiments should be repeated at the summit of Mt. Blanc, "especially if the observer can remain sufficiently long at that great height."

PROPOSED RAILWAY TO THE SUMMIT OF MT. BLANC.

The scheme for a railroad to the summit of the Jungfrau has stimulated two or three eminent French engineers to propose the greatest of all tasks of this kind—namely, a railroad, or, rather, an elevator, to the top of Mt. Blanc. The line would commence at the Miage Ravine, above Saint-Gervais, and at once be carried through a tunnel four and a half miles in length. From this point a vertical shaft 9100 feet in height would bring the traveller to the summit. The engineers are not inclined to underrate the difficulties of the scheme. The height of the vertical shaft will be more than double any now in existence. It is said, however, that the road would not cost more than 9,000,000 francs.

It would be easy to quote from many accounts of ascensions of Mt. Blanc to show the real dangers which still remain and which always will attach to this journey. The latest account will serve the purpose as well as another—and in what follows I shall give a few paragraphs from Mr. Garrett Serviss' recital of his ascent to the summit in August, 1895. In early August Mr. Serviss ascended as far as the refuge hut at des Bosses, but was obliged to return on account of a terrific storm of snow and wind. The successful journey was made at the end of the same month. Two of the illustrations in this section are taken from Mr. Serviss' excellent article in *McClure's Magazine* for May, 1896.

On the tenth of August Mr. Serviss left Chamounix with a guide and one porter. M. Janssen, then at Chamounix, predicted that the weather was sure to be fine. As far as the Grands-Mulets the dangers are few, though the crevasses near the junction are sometimes troublesome and occasionally perilous. (Madame Marke and Olivier Gay were lost here in 1870.) The night was passed at the cabin at Grands-Mulets.

It is customary to leave the cabin for the ascent to the summit about midnight in order to pass the snow-slopes before the action of the sun has loosened the avalanches and weakened the snow-bridges over the crevasses. Mr. Serviss did not leave, however, until about 3.30 A.M. At the height of 12,000 feet one comes to the Petit Plateau, "a comparatively horizontal lap of snow which is frequently swept by avalanches of ice descending from the enormous *séracs* that hang like cornices upon the precipices above. It is one of the most dangerous places on the mountain. 'Men have lost their lives here and will again lose them,' is the remark of Mr. Conway, the Himalayan climber, in describing his passage of the place. 'Many times have I crossed it,' said M. Vallot, the mountain meteorologist, 'but never without a sinking of the heart, and the moment we are over the Petit Plateau I always hear my guides, trained and fearless men, mutter 'Once more we are out of it.' . . . Above the Petit Plateau is a steep ascent called the *Grands Montées* which leads to the Grand Plateau, a much wider level than the other, edged with tremendous ice-cliffs and crevasses and situated at a level of 13,000 feet." Here they were caught in a storm and quickened their steps; "it would not do to be caught here. The Grand Plateau has taken more lives than its ill-starred neighbor below." Here the party bore off to the right amid "a wilderness of snow and ice encompassed with precipices, chasms, and pitfalls, treading on we knew not what, assailed by a wild storm, all landmarks obliterated, and our foot-steps filling so fast with drifted snow that in two minutes we could not see from what direction we had last come." (It was here that Dr. Bean, Mr. Randall, Rev. Mr. Corkendale, with five guides and three porters,—eleven persons in all,—were lost in 1870.) A fortunate break in the clouds allowed the guide a momentary view of familiar rocks, and in due time they found the refuge hut at the Rochers des Bosses. The successful ascent was made on August 29. On August 18 three persons had ascended from the Italian side, and had perished in the crevasses above the Grands-Mulets (Dr. Schnurdreher, guide, and porter). Their bodies were found August 26 and brought to Chamounix. Mr. Serviss adds the gruesome remark: "Every boy in Chamounix understands how a body should be brought down from Mt. Blanc."

The ascent of August 29 was made by the Corridor, and the day

was perfect. (See the plates.) With this we may leave Mr. Serviss' graphic recital. I have quoted it to show briefly the perils and difficulties of the ascent. Almost any one of a hundred other accounts would have served to show that the scientific achievements of the Mont Blanc observatory will have to be of the first order in order to compensate for the risks to human life which its establishment involves. Men have already died in its service, and more lives will be exacted by the inexorable conditions of this giant mountain.

When one considers that, in all probability, no scientific result will be reached on Mont Blanc which could not be attained on dozens of other peaks each accessible by railway or by entirely safe trails and at far less cost, it becomes a serious question whether the establishment of an observatory in this very unfavorable site is to be praised or blamed. In my own view there is no doubt that the same expenditure of energy and money would have accomplished a greater scientific benefit if a different site had been selected.

Atmospheric Conditions on the Riffel (8000 feet).

In the year 1886 Captain Abney made a short series of observations on the transmission of sunlight through the atmosphere, using the Riffel, Zermatt, as a high-level station.

His remarks on the atmospheric conditions at this station (*Phil. Trans.* R. S., 1887, p. 255), while interesting, are in entire disaccord with similar observations made at similar altitudes at other stations distributed all over the globe. He found little or no dust in the atmosphere, though we know that it is generally present at altitudes far greater than 8000 feet. The sky-spectrum was barely visible in a pocket-spectroscope. The sky was "blue-black." At this altitude in the Rocky Mountains, in the Sierras of California, in the Andes, on Etna, on Teneriffe, and on Mauna Loa, the two latter peaks being closely surrounded by the sea, the dust haze is almost always to be seen. The sky does not become "blue-black" until an altitude considerably greater than 8000 feet is reached. In the Rockies during three visits aggregating eight weeks or so, I have never seen the sky "blue-black" under 12,000 to 13,000 feet. It would appear that Captain Abney's observation was made under unusual circumstances.

The Riffel was occupied in 1884 by Mr. Ray Woods, but the circumstances were then specially unfavorable, and the sun was always surrounded by a "red haze."

Mountain Meteorological Stations of Europe.

Under this title and in the year 1886 Mr. A. Lawrence Rotch, Director of the Blue Hill (Meteorological) Observatory reprinted a num-

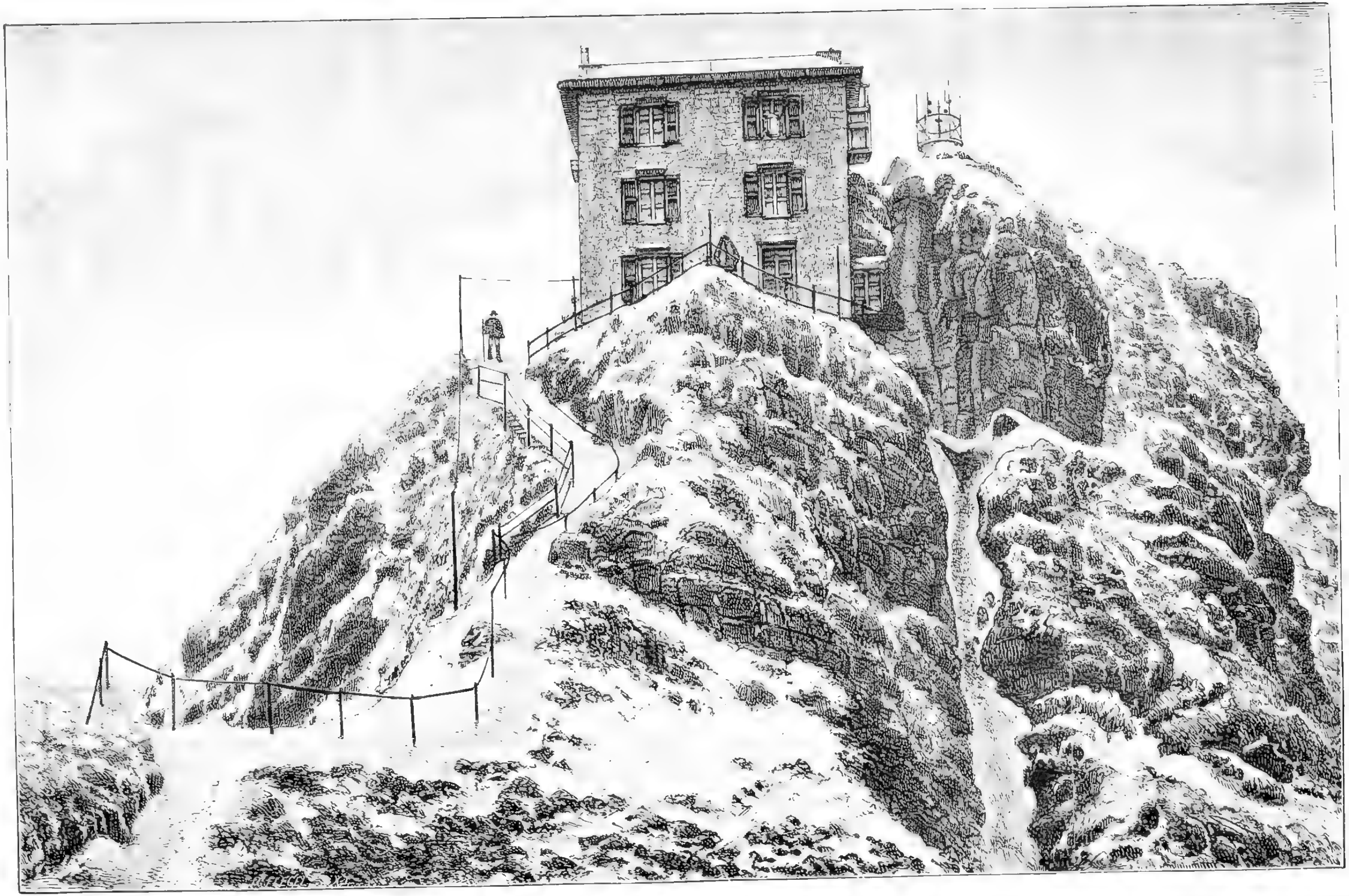

FIGURE 9.—THE METEOROLOGICAL STATION ON THE SÄNTIS (8,200 feet).

ber of interesting accounts of the high meteorological stations of Europe.

The highest German station is the Wendelstein on the northern slopes of the Alps near Munich. Its altitude is 1837 metres. The Säntis in Switzerland (2504 *m.*), the Rigi (1790 *m.*), the Great St. Bernard (2478 *m.*) are well known.

The most famous station in France is the Puy-de-Dome (about 1400 *m.*) where Pascal caused his barometric experiment to be tried in 1648; the highest station is the Pic-du-Midi (2877 *m.*). This station is particularly interesting to astronomers because its work is not confined to meteorology.* Reference should be made to Dr. Rotch's work by all specially interested in the meteorological services of such stations. Such of them as have been tested astronomically are spoken of in what follows.

THE METEOROLOGICAL OBSERVATORY ON BEN NEVIS (4368 FEET).

The summit of the Ben is a most unsatisfactory station for astronomical work. During 1893, for example, the average cloudiness of the year was 84 per cent; and in December, 1893, there was but a single hour of sunshine! The energies of the observers are, consequently, entirely devoted to purely meteorological observations.

The Meteorological Observatory on Ben Nevis had a serious experience in June, 1895. During a thunder storm, a flash entered the building, fused the telegraph wires, damaged several of the instruments, and stunned one of the observers, but fortunately did not kill him. In its passage the lightning set fire to the felt and timber lining of the building. Assisted by some tourists who had taken refuge from the storm, the observers succeeded in subduing the fire. In this connection, compare the journal of the observers on Pike's Peak.

THE METEOROLOGICAL OBSERVATORY OF THE SÄNTIS (8200 FEET).

Dr. Müller, of the Potsdam Astrophysical Observatory, spent a considerable time on the summit of the Säntis, engaged in photometric and spectroscopic observations. The former series was arranged so as to determine the absorption of the air and its effect in diminishing the visual brightness of stars. For our purposes we may quote some of his results as follows:

Stars between the zenith and 47° Z. D. showed $\frac{1}{10}$ of a magnitude brighter at the summit than at sea-level. As the zenith distances of

* The Mont-Ventoux station (6250 feet) cost about $40,000 to install; the Aigonal station (5150 feet) was established at about the same cost. I do not know the yearly budgets of these establishments, nor of the Eiffel Tower station (980 feet).

stars increased, their gain in brightness was proportionately more, so that at 88° Z. D. stars were a full magnitude brighter on the Säntis than at sea-level. In all of Dr. Müller's observations he noted the steadiness of the air, as well as its transparency, and it follows from his figures that the air was very quiet and the star-images free from twinkling.

It is difficult to make a comparison, but it would seem from an examination of the figures that the steadiness of star-images on the Säntis during these observations was considerably greater than the steadiness on Pike's Peak and in Colorado in the summer season, and materially less than that at Mount Hamilton during the months June-October. The comparison is, however, difficult to make with accuracy.

Dr. Müller's observations also related to a comparison of the solar spectrum at high and low altitudes of the sun, and thus determined the absorptive effect of a portion of the earth's atmosphere. It will be observed that the programme of Dr. Müller was concerned with problems whose solution must depend upon the comparison of observations at high and low levels. The permanent meteorological observatory afforded a convenient and comfortable station for his temporary wants. The first cost of the observatory was about 60,000 francs ($12,000), and its annual budget is 6000 francs ($1200).

THE METEOROLOGICAL OBSERVATORY ON THE SONNBLICK (9843 FEET).

From an account of the Sonnblick Observatory (3000 metres high) in *Himmel und Erde*, vol. iv, a few statistics of interest to astronomers are taken. The temperature-range (annual) is much less than at sea-level, being only 14° C. (25°.2 F.). For 100 metres' increase in altitude the temperature diminishes at the rate of $\frac{6}{10}$ of a degree C., but the rate diminishes with increasing altitude. There must be a point at which the summer and winter temperatures are alike—where there is no annual range. From the data obtained from the Sonnblick observations this height would be about 8800 metres (28,871 feet). There are, on the average, two hundred and fifty days of the year when the temperature is 0° C. or lower.

The sunniest months yet experienced at the Sonnblick Observatory during nearly seven years of observation are:

February,	1890, 205 clear hours	= 70 % of the maximum possible.			
September,	1891, 202 " "	= 58 %	"	"	"
August,	1892, 227 " "	= 52 %	"	"	"
July,	1893, 204 " "	= 48 %	"	"	"

February, 1892, had only 48 hours of sunshine, and May, 1887, only 73.

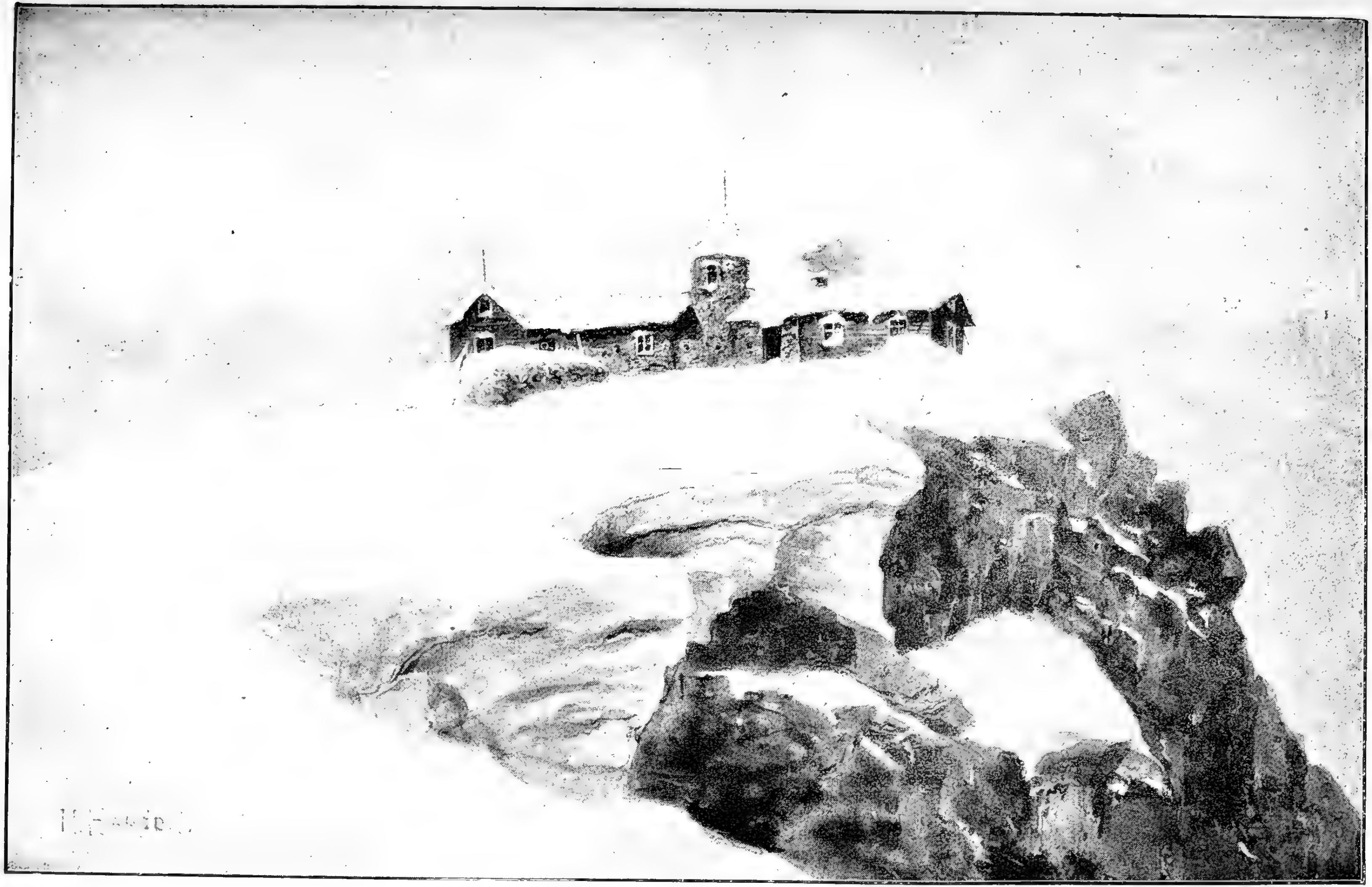

FIGURE 10:—METEOROLOGICAL STATION ON THE SONNBLICK (9,843 feet).

FIGURE 11:—PANORAMA OF THE JUNGFRAU RANGE (Eiger, Mönch, Jungfrau).

There is eight times as much snowfall as rainfall at this station.

The twinkling of the stars is regularly observed on the Sonnblick, and it is found to be considerably greater than at the lower station.

The movements of the barometer; the wind pressures and velocities; the relative humidity; the formation and movements of clouds; the amount of atmospheric electricity; and all meteorological phenomena are daily observed on the Sonnblick, and these observations are employed in daily weather predictions. But their usefulness does not end here by any means, for the observations are thoroughly discussed and digested with reference to the fundamental problems of meteorological physics by the director of the Austrian Meteorological Service, Dr. Hann, and by his assistants. The first cost of this station was 6600 Austrian florins (about $3201), and its annual budget is 200 florins ($97).

ABASTOUMAN OBSERVATORY (TIFLIS, RUSSIA, 4600 FEET).

An observatory was founded in the government of Tiflis by the Grand Duke George of Russia, at an elevation of 4600 feet, and Professor Glasenapp has made many observations of double stars with its 9-inch equatorial. The station is now, I believe, abandoned.

MOUNTAIN RAILWAYS IN SWITZERLAND.

Since Switzerland has become the playground of Europe, mountain railways have already been constructed to various summits, and summer resorts established there. Science benefits by these experiments, for meteorological stations have been installed at such favorable points.

The Mt. Washington (6279 feet) mountain railway, opened in 1869, was probably the first of the kind. It is operated like all the early mountain railways by an engine with cog-wheel drivers. The railway up the Rigi (5741 feet), opened 1873, is on the same plan. The Mount Pilatus railway (6785 feet) was opened in 1888, and is again on the early plan.

Since the completion of the Pilatus railway a considerable number of others have been built or are in process of building. A number of them are cable roads, or electric trolley lines. The Mürren railway (1891) ends at an altitude of 5350 feet in face of the magnificent group of the Jungfrau (15,700 feet).

The Swiss government has authorized the construction of a combined railway and elevator which will land the traveller at the summit of this wonderfully beautiful peak and in the centre of a grand panorama; and it is understood that the government will subsidize the enterprise.

These matters, interesting in themselves, are of importance to science because it is now certain that high-level meteorological stations in abundance are soon to be available.

In our own country the railway up Mt. Washington has long been in operation, and the railway up Pike's Peak makes that summit available. A cable-railway to Echo Mountain (3500 feet) in California has lately been extended to Mt. Wilson (6000 feet). All these peaks have been, or will be, occupied as meteorological or astronomical stations. It is worthy of remark, in passing, that the rapid change of atmospheric pressure seems to be a cause of mountain-sickness for a large proportion of visitors to the summit of Pike's Peak, and even to some of the lower summits.

British India.

Hospitality is asked for a note in this place on a high-level observatory about to be established in British India.

THE KODIAKANAL SOLAR PHYSICS OBSERVATORY IN THE PALANI HILLS, INDIA (7700 FEET).

This new observatory, founded in 1895, is described by its Director, Mr. C. Michie Smith, in the *Publications of the Astronomical Society of the Pacific*, 1895. Its climate is utterly different from anything with which Europeans or Americans are familiar, as may be seen by a glance at the paper cited. There are over 2000 hours of sunshine yearly, and the experiments so far conducted show that the atmosphere is steady as well as clear. It is worthy of notice that very careful tests had been made of several sites before the site for the observatory was finally fixed.

FIGURE 12:—MT. CHACHANI, FROM THE AREQUIPA OBSERVATORY.

CHAPTER II.—THE OBSERVATORIES OF SOUTH AMERICA.

Dr. Copeland's Astronomical Experiments in the High Andes of Peru (1883).

During the early part of the year 1883, Dr. Ralph Copeland, now Astronomer Royal for Scotland, spent some months at high stations in the Andes for the purpose of testing their suitability for astronomical work. He had with him a 6-inch refractor and thus was able to make real tests. The principal stations occupied were La Paz (12,050 feet) Puno (12,608 feet) and Vinocaya (14,360 feet). At the latter place the sky was very pure during his first visit (March 1–16), and on the few occasions when the telescope could be used the definition was very good. At a second visit, June 5 to 27, there was a much greater proportion of unclouded weather, but on the other hand there was more dust in the atmosphere. At Puno, also, there was often dust in the atmosphere and the sky was milky from this cause. July to December is the unclouded season. Dr. Copeland's conclusions are that observing stations can certainly be found in the region examined that would possess great advantages over sites in Europe. Considering everything he seems to favor a medium elevation, say 12,000 to 13,000 feet, rather than a higher level. The whole report is of much value to astronomers.

Dr. Copeland remarks that the people who reside permanently at 14,000 feet elevation in these countries seem to be entirely healthy and to do a full day's work; and he makes the clever observation that the hammers in the machine shops at Vinocaya (14,360 feet) were as heavy as those used in England.

Mountain Stations Established by the Harvard College Observatory in Peru.

The astronomical station of the Harvard College Observatory in Peru is in the town of Arequipa (8060 feet). Fourteen miles from Arequipa is the mountain Chachani (20,000 feet) which is always snow-capped. A station has been established on the slopes of this peak 16,650 feet above sea-level. The ascent from Arequipa can be

made on mule-back in about eight hours and the self-recording instruments of the station are visited periodically. Mountain-sickness, in some form, is almost invariably experienced by visitors. This high-level station is only a part of an extensive series of meteorological stations established by the Harvard College Observatory.

Another high-level observing station is on the summit of El Misti, 19,200 feet high. In February, 1894, the Misti was covered "with enormous quantities of snow." It is intended to establish other meteorological stations on the eastern slopes of the Andes, so as to make a thorough study of the climate from the Pacific eastwards.

A high-level meteorological station has also been opened at Cayalloma (15,500 feet) and 70 miles north of Arequipa.

The line of meteorological stations maintained by the Harvard College Observatory now (1895) extends from the coast, across the Andes, to the valley of the Amazon. They include Mollendo (altitude 100 feet), La Joya (4150), Arequipa (8060), Alto de los Huesos (13,300), Mt. Blanc station on the Misti (15,600), El Misti (19,200), Cuzco (11,000), and Santa Ana (3000).

Near Arequipa there are three very high peaks—Pichupichu (18,600 feet), El Misti (19,200), and Chachani (20,000).

In *Appalachia* (vol. vii.) Prof. W. H. Pickering gives a very instructive account of his ascent of El Misti, which is an active volcano, as has been mentioned. The Indian guides and porters, carrying fifty pounds, were not at all affected by mountain-sickness and kept in front of the best climbers of Professor Pickering's party. At 16,600 feet one of the party was obliged to give up the ascent on account of a severe attack of mountain-sickness. All the party were much affected at the last camp (18,440 feet). Professor Pickering and the guides alone reached the summit (19,200 feet) on the next day.

Mr. Waterbury, formerly of the University of California, was in charge of the meteorological instruments on El Misti, etc. (19,300 feet), till 1896. It was his duty to make the ascent once in ten days at least, and he has accomplished fifty-two such ascents. Most persons, he says, are greatly distressed by mountain-sickness at such elevations, but he "experienced little trouble." "Wind is always blowing on the mountain at a rate of 30 miles per hour; and the temperature ranges from + 38 ° to 0 ° F. The trip occupies two days, the first night being spent at a shelter station at 6000 feet. The rest of the ascent takes five hours. A bridle-path has been made after great difficulty, to the summit and mules now go to the top, the highest elevation that they have ever reached."

Professor Pickering has some further remarks on mountain-sickness as observed at a mountain camp on Chachani at a height of 16,600

FIGURE 15:—EL MISTI, FROM THE AREQUIPA OBSERVATORY.

feet in 1892. A hut was built here and a bridle-path led to it and a number of visitors went as high as this, riding on mules. It sometimes happened that a visitor would arrive perfectly well, and fifteen minutes later be completely prostrated. Recovery was sometimes rapid, but usually not so:

> We found that all persons with blood of the white races in their veins were subject to the complaint, the pure-blooded Indians only being more or less exempt. Half-breeds who had spent all their lives in Arequipa were often more susceptible to it than ourselves. In my own case this susceptibility rapidly wore off and after my first night on the Misti I never again felt any very serious inconvenience.

Professor Pickering went to a height of 19,000 feet on Chachani without any premonitions of mountain-sickness.

The summit of this high mountain, Chachani, is said to have been reached by several persons, but there is no authentic record of such ascent until May, 1893, when Professor Schaeberle, of the Lick Observatory, in company with Professor Bailey, Mr. Duncker, and three natives, attempted the ascent. Professor Schaeberle and one native reached Little Chachani, a peak two or three thousand feet below the principal summit, the others being prostrated with mountain-sickness. From his report on the solar eclipse of April, 1893, the following notes are taken:

> At the first camp (about 16,000 feet in elevation) the sky was not deep blue but hazy. A four-inch telescope was used at night on bright stars and the moon. "While the character of the images was less favorable than at Arequipa, the curious feature of very active commotion in the stellar image without any accompanying blurring, and the diffraction-rings, appeared much the same as at the observatory below. The moon's image also had the same woolly, surface-creeping look."

Professor Schaeberle's remarks on mountain-sickness are very instructive. One member of the party (Mr. Duncker) was seriously affected and became delirious. He reached a height of about 16,800 feet. On the next day Professor Bailey was obliged to give up the ascent at about the same elevation. The Indian guides were not in the least affected, either by cold or mountain-sickness; they ate freely and carried considerable loads. Professor Schaeberle's full and interesting report (*op. cit.*) should be read. He is of the opinion that it will always be impossible for observers to live and work at these great altitudes.

The main interest to astronomers in the Harvard College Observatory expeditions to South America is in the establishment of a well-equipped observatory at Arequipa (8060 feet). Here a large equatorial of thirteen inches aperture was installed in 1891, and it has been

kept in full activity since that time. Every class of observing has received attention—double stars, observations of the moon, planets, and satellites, stellar spectra, photographic star-charts, zodiacal light observations, etc., and thus the materials for a judgment on the advantages of the station are at hand. Professor W. H. Pickering's conclusions are, in brief:

The transparency of the sky was such that it was a common occurrence to see third-magnitude stars set below the horizon where it was on the level with the eye.

With the 13-inch telescope ten and twelve diffraction-rings have been counted under favorable circumstances around the brighter stars, each ring being nearly if not absolutely motionless.

Powers of 1140 diameters have been used to advantage on *Venus* in the daytime, and the phases of *Jupiter's* satellites are seen as they enter the planet's shadow at eclipse. This phenomenon has probably never before been seen with a 13-inch telescope.*

The sky is always clear in the dry season, and during most of the mornings of the rainy season from November to April or May.

There can be no doubt that the astronomical observatory at Arequipa is far more favorably situated as to observing conditions than most permanent observatories. There is no question that its skies are more transparent, and the stars more steady than at fixed observatories in the eastern parts of the United States, for example, or than most observatories in England and on the continent of Europe. It is more difficult to obtain an accurate comparison between the steadiness of the atmosphere at Arequipa and at California observatories as Mt. Hamilton, Mt. Wilson, and Echo Mountain. The Harvard College Observatory maintained an observing station for some years on Mt. Wilson, and it is the verdict of the observers, I believe, that Arequipa is superior both in respect of transparent air and of steady definition. A few comparisons have been made by astronomers of the Lick Observatory between the conditions at Mt. Wilson and at Mt. Hamilton, with the general result that the best seeing at the two places is practically of the same excellence.† This would make the best conditions at Arequipa superior to those at Mt. Hamilton. A direct comparison between the two places was made by Professor Schaeberle of the Lick Observatory in 1893.

Professor Schaeberle stayed at Arequipa about two weeks (in the latter part of May), and with regard to the transparency of the sky ob-

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* It is always seen at Mount Hamilton with the 36-inch equatorial.—E. S. H.

† Professor Barnard says of Mt. Wilson (July 18, 1892) that he has "nowhere seen a finer, clearer sky."

FIGURE 14:—ILLAMPU (the Highest of the Andes) AND THE SORATA RANGE, SEEN OVER LAKE TITICACA.

served that "the sky-glare was much more pronounced than it is at Mount Hamilton in favorable weather." Through the kindness of Professor Bailey, in charge of the observatory, opportunities were given to use the 13-inch equatorial visually. Professor Schaeberle (Eclipse-Report of April, 1893, p. 21) remarks that "the brighter stars were surrounded with many well-defined diffraction-rings,* which did not seem to be affected by the apparently great commotion in the stellar disk and rays—a curious kind of rapid twinkling without blurring. On turning to the moon I remarked that the seeing was 'woolly,' the effect of minute atmospheric waves plainly visible in the slight movements of the lunar surface. At the Lick Observatory the same quality of seeing would be classed about 4 on a scale of 5 for the best seeing." The conditions were regarded by Professor Bailey as excellent on the nights to which Professor Schaeberle refers.

Mr. A. E. Douglass, one of the astronomers of the Arequipa Observatory, has a few sentences relating to the conditions affecting the vision there in the *American Meteorological Journal* (vol. II., p. 395) as follows:

> The observatory is situated close to a river valley, down which, on clear nights, a swift stream of cold air descends. This frequently attains such a volume as to flow over the observatory grounds.
>
> When this cold air reached the [telescope] the seeing was immediately ruined. When this current once became established no more good seeing could be expected for the remainder of the night.

The foregoing comparisons between the best conditions of steady vision at Mt. Wilson, Arequipa, and Mt. Hamilton are interesting; they are probably not decisive. A comparison of the results of observation at the three places is difficult to make on many accounts. Another question of importance is the relative number of good observing nights (and days) at the three stations. This is a question which can be settled by statistics.

It is of considerable importance to obtain some definite notion of the relative excellence of observing stations in different parts of the globe. The main factor to be attended to is that of steady definition. It is known, to begin with, that a transparent air can be found in elevated regions nearly everywhere. For an astronomical station steady definition is much more important.

Where is this condition to be found? On Etna—in Egypt—in the

* Professor Schaeberle tells me that the expression "many" rings is correct. Professor W. H. Pickering says ten or twelve for bright stars under favorable circumstances. It is difficult to understand how many rings can be seen with a central disk which is quite unsteady.

Californian mountains—on the high, dry plains of Arizona—in Mexico—in the Andes—in Japan—or in which of these regions?

Wherever it is found, there is the place to install a large equatorial to be devoted to observations of the most difficult and delicate nature—to the settling of mooted questions—to discovery, in short. It is only in such situations that a great telescope will do full justice to its constructor and will afford the fullest scope to an accomplished and diligent observer.

Professor W. H. Pickering has been kind enough (in a letter of April 8, 1895), to give me a direct comparison between the astronomical conditions at Arequipa, Mt. Wilson, and Flagstaff, which he is better able to make than anyone else:

Regarding a comparison of the three observatories, Arequipa, Mt. Wilson, and Flagstaff, I think the sky was somewhat more transparent at the former, since fainter stars could be seen in the horizon. On the other hand I doubt if the difference was a practical one at altitudes over 30°. In fact, even at Cambridge, I do not believe there is very much light lost on a really clear night. The great advantage of the former stations, to my mind, was that the transparency was *the same* night after night, for perhaps a month at a time, so that similar observations, on comets for instance, could be conducted under identical conditions for considerable periods. I think there is no doubt that the moon appears whiter in Arequipa than in Cambridge, and the same remark applies, possibly in a less degree, to the two other stations. My only knowledge of the steadiness at Mt. Wilson is derived from photographs, and the statement of Mr. Lowell that on the night he looked through Professor Swift's telescope, which was said to be an average night, the seeing seemed to him to be about as good as at Flagstaff. Upon one or two occasions it seemed to me that the seeing at Flagstaff was as good as anything I had seen at Arequipa, but the difference was that while at Arequipa such seeing was common, at Flagstaff it was very rare.*

Still the average at Flagstaff was probably better than the best we have at Cambridge—it was certainly as good. My observations at Flagstaff lasted practically from June 1 to December 1. After the latter date there were many clouds and the seeing was very bad. Regarding the number of nights on which photographs could be taken, I am inclined to think that there was little to choose between the three places; perhaps 70 per cent of the nights were suitable. In Arequipa, however, the clouds were often very thin and of such a character that while showing structure they were not accompanied by bad seeing. Therefore upon these nights visual observations could be conducted upon bright objects, like the moon and the planets, and perhaps 80 to 85 per cent of the nights throughout the year could be so utilized.

One characteristic of Arequipa was that the seeing was excellent in the afternoons beginning at perhaps 4 o'clock. In the early morning, *i. e.* after midnight, the seeing at Arequipa was frequently bad.

This was apparently due to a local cause—the formation of a cold stream of air which followed down the river-bed from the interior. It is probable that at a site located a few miles back from the river this current would be avoided.

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* In making this statement I allow for the difference in the apertures of the Arequipa and Flagstaff telescopes. With the latter instrument one would necessarily be more critical.

FIGURE 15.—CHIMBORAZO. (20,545 feet).

Mr. Whymper's Expedition to the Andes of Ecuador.

The first sentence of Mr. Whymper's book propounds the question which his expedition to the Andes was intended to solve. "It has long been much debated," he says, "whether human life can be sustained at great altitudes above the level of the sea in such a manner as will permit of the accomplishment of useful work"—of useful scientific work, I understand him to mean. There is no question, he goes on to say, that it is possible to exist at great elevations for short periods. Balloon ascensions have fully demonstrated this fact.

Mountain-sickness has long been known to occur at altitudes above, say, 14,000 feet; and this in all parts of the world. Mr. Whymper's main object was to determine whether a prolonged residence at high altitudes might not do away with the depressing effects of mountain-sickness, and generally to study the physiological as well as the more practical aspects of the question.

De Saussure on Mont Blanc (15,780 feet) found himself unable to perform, in four and a half hours, the experiments for which less than three hours were sufficient at sea-level.

Darwin found it "incomprehensible how Humboldt and others were able to ascend to the elevation of 19,000 feet."

The brothers Schlagintweit ascended to great heights in Asia, and Mr. Whymper understands them to say that they became somewhat habituated to low pressures; although they also say that at heights of some 22,000 feet, it had become practically impossible to go farther, and that all the party was sick.

Mr. Whymper's plans pre-supposed that the experiments should be made by persons previously accustomed to mountain-work; that a prolonged sojourn should be made at elevations above, say, 15,000 feet; and that all discomfort should be eliminated so far as possible. Circumstances compelled him to select the high Andes of Ecuador as his field of work.

Mr. Whymper's own experience had been very wide, and his party included J. A. Carrel, an old Swiss guide, Carrel's cousin Louis, and a native of Ecuador. The first three were highly skilled mountaineers, and no one of them had ever been affected with mountain-sickness in the least degree. Their work had, however, all been done at elevations less than 16,000 feet. They reached their very first camp on Chimborazo (16,664 feet) by riding on mules. Mr. Whymper, at least, had not made any very severe exertion, yet he and both the Carrels were at once attacked with the mountain-sickness.

The party stayed on Chimborazo, at this time, for 17 days. One night had been passed at 14,375 feet, ten at 16,664, and six others at 17,285 feet. The summit was reached once (20.545 feet) and three

times Mr. Whymper went to a height of 18,528 feet. Mountain-sickness had been experienced by all at a height of 16,600 feet; but "in course of time the more acute symptoms disappeared," though only a slight decrease of pressure could be sustained without bringing it on once more.

The volcano Cotopaxi (19,613 feet) was next attacked, and a camp was established at 15,139 feet altitude. Twenty-six hours were passed at or near the summit, and during this time there was no recurrence of the mountain-sickness which had been so marked on Chimborazo. Mr. Whymper remarks especially that there was no work to tax their strength, and says "it is by no means certain, if larger demands had been made upon it, that our condition would have remained equally sound."

After ascending various peaks, Antisana (19,335 feet), Cayambe (19,186 feet) among them, Chimborazo (20,498 feet) was ascended a second time without experiencing the *acute* symptoms of mountain-sickness. Something like seven months had been spent at high altitudes, and the party had become habituated to low barometric pressures.

Mr. Whymper devotes some twenty pages of his book to a discussion of his observations upon mountain-sickness. A small part of these observations has been summarized in what has gone before.

The important question is, can one become accustomed to low pressures, so that work can be accomplished at high altitudes with about the same facility as at lower ones?

Mr. Whymper's conclusion from all his experiments is that "we became *somewhat* habituated to low pressures," but he at once limits this statement. A crucial experiment showed that he himself, a skilled mountaineer, was "materially affected by and weakened at a pressure of twenty-one inches (9850 feet)."

Certain effects—increased circulation, fever, and general illness—were transitory, and disappeared after the explorers had become accustomed to great heights. These are the *acute* symptoms of mountain-sickness, and Mr. Whymper supposes them to arise from the difference of pressure between the external air and the internal gases of the body. In time an equilibrium is brought about, and the acute symptoms disappear.

Other effects are permanent so long as the person remains at a low pressure. These are chiefly due to a great increase in the rate of respiration. At rest, it was not too difficult to maintain life by increasing the volume of air inspired. The least exertion, however, made it extremely difficult to inhale sufficient air. Mr. Whymper examines the proposal of M. Paul Bert to inhale oxygen, and shows that however useful this may be for persons who pass rapidly from

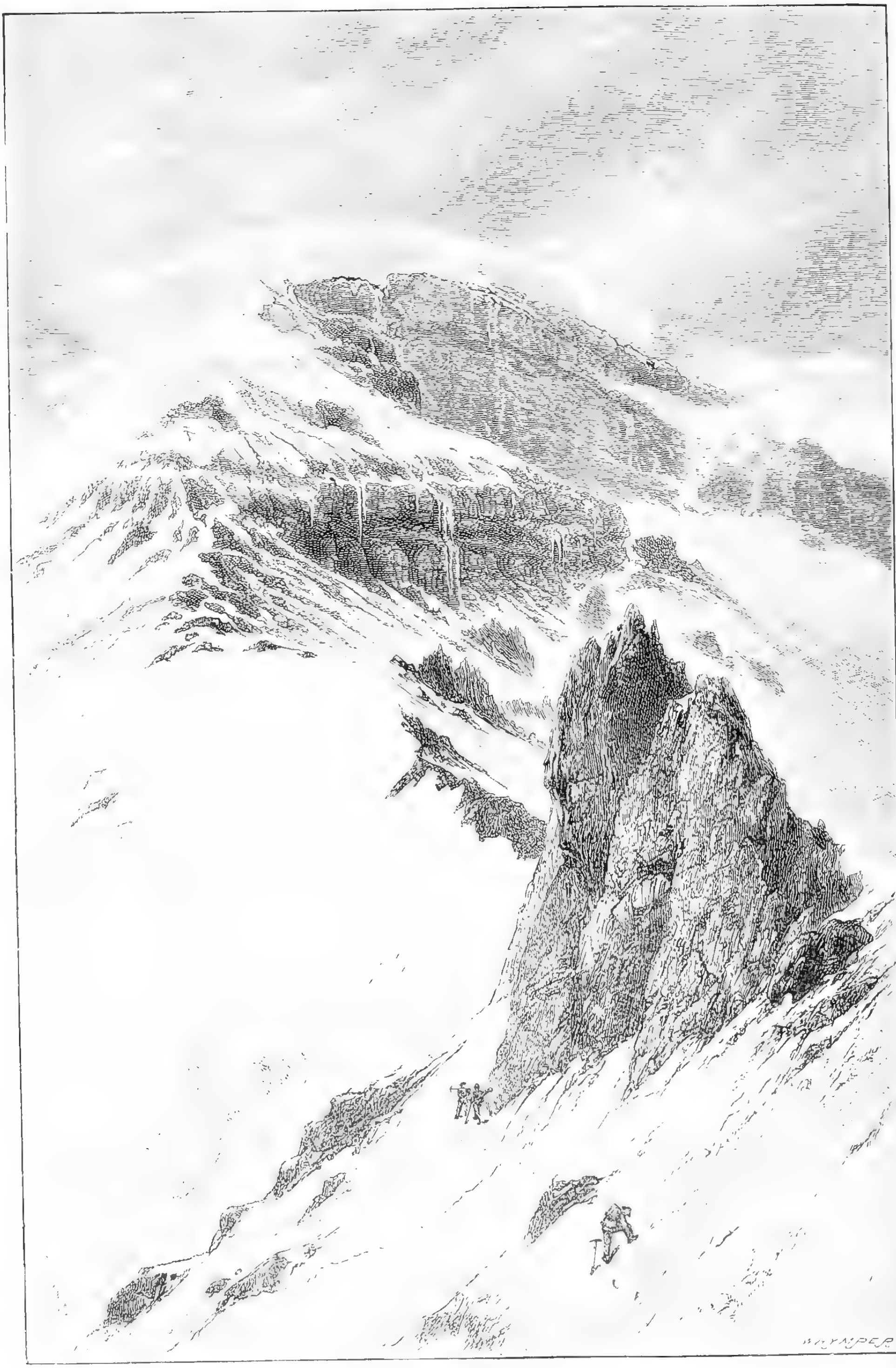

FIGURE 16.—CHIMBORAZO FROM A POINT 17,450 FEET ABOVE SEA.

high to low pressures it certainly would have been of no service in his own experience.

Finally his conclusions are that ascents should be made gradually, so as to avoid the *acute* symptoms above mentioned; but that it is and will always be impossible for persons to live at extreme altitudes without a great loss of muscular powers. The question of a corresponding loss of mental alertness he does not examine. (See in this connection the remarks of M. Janssen, page 24, note.

The heights of the mountains climbed by Mr. Whymper are materially greater than that of the highest peak in Europe, but it is to be remarked that Mr. Whymper's experiments prove that even at comparatively moderate elevations (9,850 feet) he was "materially affected and weakened," and this at a time when he was in the best of training. The conclusions bear directly on the main question of this book. It is clear that the generality of persons can become habituated to low pressures so as to escape all the acute symptoms of mountain-sickness; but if Mr. Whymper's conclusions are to be relied upon it is not possible to live at elevations of 10,000 feet or so without losing a considerable part of one's normal muscular powers. At elevations of 15,000–16,000 feet this loss will be very considerable.

Boussingault, in his account of the ascent of Chimborazo (1831), speaks of all his predecessors in the Andes as having been much affected with the mountain-sickness. For himself and his companion, Colonel Hall, the case was different. No acute symptoms were felt, which he attributes to the fact that they had lived for a long period at very great elevations. He notes the fact that the inhabitants of cities in the high Andes (Bogota, Potosi,* etc.) at 2900 to 4000 metres are not so affected, and describes balls in these cities where the young women dance the whole night, just as in Europe; bull-fights in Quito; and a pitched battle at Pichincha, which is about the height of Mont-Blanc. The fighters, men and bulls, were equally affected by the height, and their combats may not have been up to a European standard; but the dances are conclusive! The best evidence on the subject, however, comes from Dr. Copeland, who found the hammers in a machine shop in the Andes (14,000 feet) of the same weight as those at home in England. All the evidence shows that the natives of the Andes do not suffer materially at high elevations, even up to 19,000 feet.

The National Observatory of Brazil (3500 feet).

The observatory of Rio de Janeiro is to be removed to Petropolis (3500 feet), but I have not been able to find any reports on the astronomical conditions which prevail there.

* Potosi (4100 metres) formerly contained 100,000 inhabitants.

CHAPTER III.—THE OBSERVATORIES OF NORTH AMERICA.

Meteorological Station at Mount Washington (6279 feet).

This station was occupied as a signal station by the United States Government for seventeen years, and was closed in 1888.

The mean temperature at Mt. Washington is about 26° F., the highest observed was 74°, the lowest, – 50°, the average daily range being about 14°.

"Mount Washington not only has higher winds than the summit of Pike's Peak for short periods, but also for days and months. On February 27, 1886, the mean hourly velocity at Mt. Washington was 111 miles for the entire day, and in January, 1878, the extraordinary velocity of 186 miles per hour was recorded." The wind at the summit has about five and one half times the velocity at sea level. The mean annual cloudiness at this station is 57 per centum, and the cloudiness, together with the high winds, makes the summit quite unfit for ordinary astronomical observations.

For completeness I may add that a railway to the summit has been available since 1869.

Astronomical Observations at Summit in the Sierra Nevada (7200 feet). By Professor G. Davidson.

Professor Davidson's report to the Chief of the Coast Survey begins thus: "In accordance with a plan I submitted to you on the 16th of February (1872) I occupied a station . . . at Summit . . . to determine whether great elevations were better than small ones for astronomical observations." The station was occupied during July and part of August, 1872. Meteorological records for 358 consecutive days (December, 1866, to December, 1867) show 270 of them to have been clear. The total snowfall was 45 feet.

The astronomical observations and tests at Summit were made with two telescopes. With the first (aperture, 2 inches; magnifying power, 35 to 40) the companion to *Polaris* was seen. This, however, is not remarkable. It has been seen in New York City by Dr. Henry

FIGURE 17.—DISTANT VIEW OF PIKE'S PEAK. (14,134 feet).

Draper with an excellent telescope owned by him, of $1\frac{1}{4}$-inch aperture and power of 60. The second telescope employed at Summit was of 3-inch aperture with powers of 60 or 65 and 250. The tests were made on *Polaris*, *Saturn*, the moon, the sun, and a few double stars. The results were very favorable for steadiness of the images; and it is noteworthy that the solar image was extremely sharp and steady. The excessive snowfall would unfit this station for permanent occupation. The same remark applies to the station first selected for the Lick Observatory at Lake Tahoe.

U. S. Coast and Geodetic Survey Station, Sherman, Wyoming (8335 feet).

In 1872 the U. S. Congress appropriated the sum of $2,000 to enable the Superintendent of the Coast Survey to make "astronomical observations at one of the highest points on the line of the Pacific railroad." During the summer of 1872 a station was occupied by a party under Mr. R. D. Cutts, of the Survey, and astronomical and meteorological observations were made.

Mr. Cutts reports the sky as "indescribably brilliant," and the stars as very steady.

Professor C. A. Young was invited by the Coast Survey to occupy this station, and spent the months of June, July, and August, 1872, at Sherman, engaged in astronomical observations, chiefly spectroscopic. He brought with him a 9.4-inch equatorial by Clark, with its spectroscope. The number of good days was small—about one in three. "But when the sky was clear, it was beautifully so." Many 7th magnitude stars were visible to the naked eye. *Alpha Lyræ* was several times observed with the naked eye from 10 to 15 minutes before sunset. Most of Professor Young's work was done in the daytime on the sun, but on 7 nights from 3 to 4 hours were spent in the observatory. On two of the nights the seeing was perfect; on two others, fine; on three it ranged from fair to poor. Finally, Professor Young states it as his deliberate opinion that a 9.4-inch object-glass at Sherman is just about equal to a 12-inch at sea-level.

It is important to remark that this expedition of Professor Young's was the first one in which a telescope of considerable power was continuously used at a high elevation. His results, and specially his spectroscopic results, soon became widely known, not only in scientific circles but throughout the world. The establishment of the Lick Observatory on a mountain was partly due to his success, and the Lick Observatory is the forerunner, and in some sense the parent, of the mountain astronomical observatories of to-day.

Sherman was by no means an ideal station, but the observations of Professor Young, and especially the spectroscopic observations of the sun, showed the immense advantages of a high-level station far above the dust and mists of the lower atmosphere, when the condition of steadiness was added to that of transparency.

It is not necessary to give an account of these spectroscopic observations which are well known to all interested,* but it may be mentioned that at Dartmouth College Professor Young had been able to map 103 spectral lines which are reversed in the chromosphere. In six weeks at Sherman all these were verified and 170 new ones added. This is a striking proof of the excellence of the atmospheric conditions and of the assiduity of the observer.

Rocky Mountain Stations in Central Colorado.

During the summer of 1873 I spent several weeks in Colorado, always at altitudes above 5000 feet, and frequently at 9000 and 10,000—and occasionally at heights of 13,000 feet and even more. The region around Pike's Peak, on its flanks, and throughout the South Park, was pretty thoroughly traversed—at Manitou, Florissant Valley, Central City, Idaho Springs, Fairplay, Mount Bross (near Mt. Lincoln), Cañon City, etc. In July, 1878, this region was again visited and I made a stay of about a week at Central City (8400 feet) and vicinity. A third visit was made in December, 1885. On all these occasions comparisons were made (with the naked eye, opera-glasses, or small telescopes) between the conditions of vision at Washington and those in the Rocky Mountains. Objects with which I was familiar (usually groups of stars, as the region bounded by the four brightest stars of *Ursa major*, of *Lyra*, etc.) were studied and mapped at both stations to determine the relative transparency of the air in the East and in the Rocky Mountain region in question; and careful notes were made of the relative amounts of twinkling of the stars at both stations.

During six journeys across the continent from the east to the Pacific and return in the years 1881, 1883, 1885, 1886 similar experiments were made, whenever possible, both on the Southern Pacific and Union Pacific railways. All these observations taken together simply confirmed the conclusions reached in 1873, which I then reported to the Superintendent of the U. S. Naval Observatory and to astronomers in Washington. These conclusions briefly stated were:

1. The transparency of the air at heights of 6000–14,000 feet in this Rocky Mountain region was always markedly superior to that at eastern stations, as was to be expected.

* *See* Professor Young's book, *The Sun.*

2. The steadiness of the air, as tested by the absence of scintillation of the stars, was usually *inferior* to the steadiness at Washington.

3. A very few nights at the western stations were not only extremely transparent but very steady; and thus superior to anything to be experienced in the east. But, unfortunately, such nights were very exceptional. The practical conclusion from all this was that there was no reason to believe that the 26-inch telescope of the Naval Observatory would do better service, on the whole, in this region of the Rocky Mountains than at Washington. This conclusion was reported to Dr. Henry Draper in 1874, and was tested by him in his journeys to Wyoming, Utah, and Colorado in 1876, and it was entirely confirmed by his independent observations in various parts of the Rocky Mountain region. It has since been confirmed by parties from the Harvard College Observatory (1887), also, for certain selected stations.

Professor Campbell, now of the Lick Observatory, left the observatory of Ann Arbor to become head of the Department of Mathematics in the University of Colorado, at Boulder (5,500 feet), where he spent several years. His report is that the sky is of great purity, but that the stars are extremely unsteady; thus adding one more bit of expert testimony and again confirming the general verdict as to the conditions to be found in the Rocky Mountains generally.

I have no doubt that the final verdict upon the Rocky Mountain region in Montana, Wyoming, Colorado, and at least part of New Mexico will be that it is not in general desirable to establish permanent astronomical observatories on high mountains in these States. It is possible that special stations *may* be found where special local conditions may change this general conclusion. The States of California, Arizona, and part of New Mexico will, probably, always be preferable to the Rocky Mountain region proper, for mountain, astronomical, observatories.

Rocky Mountain Stations in Utah, Wyoming, and Colorado.

In August and September, 1876, Dr. Henry Draper made a journey in the Rocky Mountains and paid especial attention to the conditions of the atmosphere for astronomical observations. He took with him a small but very perfect achromatic telescope of $1\frac{1}{4}$ inch aperture and magnifying power of 60 diameters. Stations in the Wahsatch Mountains of Utah and in the Rocky Mountains of Wyoming and Colorado, from 4500 to 11,000 feet in elevation, were occupied. Professor Draper's general conclusions were:

On the whole, the astronomical condition, particularly for photographic researches, is unpromising. In only one place were steadiness and transparency combined, and only two nights out of fifteen were exceptionally fine. The trans-

parency was almost always much more marked than at the sea-level, but the tremulousness was as great as, or even greater than, at New York. It is certain that during more than half the year no work of a delicate character could be done. . . . Apparently, therefore, judging from present information, it would not be judicious to move a large telescope and physical observatory into these mountains with the hope of doing continuous work under the most favorable circumstances.

Professor A. Hall, Sr., observed the eclipse of July, 1878, at La Junta, which lies in the elevated plains of Colorado, about 4187 feet above the sea. "I cannot but think," he says, "that these elevated plains afford advantages for astronomical observations that have not hitherto been made use of"—which was true then, and is largely true to-day.

In July, 1878, Mr. Alvan G. Clark used a high-power eyepiece on a 3-inch telescope at Creston (Wyoming), altitude 7000 feet, and examined some close double-stars for about two hours. His verdict was that *Epsilon Lyræ* was "as well shown as he had ever seen it at Cambridge with a 12-inch glass!!!" The two hours in question was the only good observing weather during the stay of the eclipse party of which he was a member.

Project for the Establishment of a Branch Naval Observatory on the Western Plains (1878).

In the early part of 1878 the Hon. A. S. Paddock, U. S. Senator from Nebraska, addressed a letter to the Secretary of the Navy on the matter of the establishment of a branch of the U. S. Naval Observatory at some elevated station in the interior of the continent. The letter was referred to the Superintendent of the U. S. Naval Observatory, and his endorsement, together with those of Professors Hall, Harkness, Eastman, and Holden, is printed in *Miscellaneous Document*, No. 25, U. S. Senate, 45th Congress, 2d Session.

Admiral John Rodgers is in favor of the project, but points out that a suitable site can only be found by trials, and recommends that an appropriation of $12,000 be made for the purpose of making such trials, and that, when the proper site is found, a branch observatory be located there which shall be devoted chiefly to work of discovery. Admiral Rodgers points out in clear and forcible language that the largest part of the work of a Government observatory is of a routine character, useful if not brilliant; and that such work will always be better done near to the centres of intelligence, "where libraries are found, where opinions are interchanged, and aims are canvassed, where artistic skill is to be met, and supply of material is to be found. The observatory of discovery should be a branch of the observatory of use-

ful work." (I presume that for "useful" one should read "more immediately practical.") Professor Hall reports that for some time he has been collecting evidence on the question and now thinks "that by establishing a large telescope on the lofty plains of the West, we have a simple and an easy means of making a forward step in practical astronomy." The opinions of Professors Harkness, Eastman, and Holden agree with those just cited from general considerations; and the latter is able to refer to some experiments of his own in 1873 on the subject, which support the general conclusion. The proposal of Admiral Rodgers to make a series of actual trials of proposed sites was suggested to him by the programme for the Lick Observatory prepared in 1874 by Professors Newcomb and Holden.

THE LICK OBSERVATORY ON MOUNT HAMILTON (4209 FEET).

The observatory on Mt. Hamilton was built under the direction of successive sets of trustees appointed by Mr. Lick, essentially on the plans prepared by Professor Newcomb and myself in 1874.*

An inspection of the many plans and projects submitted to the Lick Trustees during the years 1874 onwards would show more plainly than any other process can how little was then generally known of the conditions which should govern in the selection of a site for a mountain observatory and in the construction of its buildings, etc. The long legal and other delays in the construction of the Lick Observatory (1874–1888) were very costly, but their compensation was obtained in the opportunity for a thorough discussion of all details. The final result has been singularly free from errors of commission; and the omissions have been repaired as far as the available funds have allowed. The principles which governed here were sound, and their successful application has been of much service to many other establishments.

Some of the sites first proposed are now known to be buried in snow for months together; some of the constructions then suggested would be absolutely unworkable here; and some of the astronomical conditions then laid down as essential cannot be realized in any mountainous country. Each point was carefully studied in detail; advice was sought from those most competent to give it; and nothing was decided upon until its effect on future plans was understood. After the searching test of actual use during the years 1883–1896 it may fairly be said that the result is, on the whole, successful, and that the real difficulties have been fairly met and conquered.

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* See *Publications of the Lick Observatory*, vol. I, 1887; and also *Publications of the Astronomical Society of the Pacific*, vol. IV, (1892), page 139.

Professor Burnham's Experiments on Mount Hamilton in 1879 (August 17 to October 17).

In 1874 I suggested to the Lick Trustees that Professor Burnham, using his 6-inch Clark refractor, should test the sites proposed for the Lick Observatory before any final selection was made. In 1875 Mr. Lick selected the summit of Mount Hamilton, after some preliminary tests had been made by Captain Floyd, President of the Lick Trustees, Mr. Frazer, and others, with small telescopes.

Professor Burnham's expedition of 1879 was very important in its systematic examination of double-stars and in its comparison with the conditions obtaining at Chicago. During the whole period of sixty days Professor Burnham reports: First-class nights 42; medium 7; cloudy and foggy 11. His general conclusions may be quoted here, although they are well known, because they have been confirmed by our long experience. They are, in brief, that "there can be no doubt that Mount Hamilton offers advantages superior to those found at any point where a permanent observatory has been established [up to 1879]. The remarkable steadiness of the air, and the continued succession of nights of almost perfect definition are conditions . . . not to be met with elsewhere."

In 1881 Professor Burnham and myself made a stay at Mount Hamilton, after a season of observation at Madison, Wisconsin, which had not changed the opinion above quoted. It is interesting to remark that the site chosen for the 40-inch Yerkes refractor of the University of Chicago lies about midway between Chicago and Madison. Unless the conditions at Lake Geneva, Wisconsin, are distinctly better than those of the region near by, its selection as a site for the largest of telescopes may turn out to have been an error of judgment.

Dryness of the atmosphere: Meteorological observations taken at Mount Hamilton during the years 1888 to 1896 will soon be printed in a special volume of the *Contributions from the Lick Observatory*. An inspection of such tables in detail will exhibit, better than any words, the remarkable conditions which exist here during the most favorable observing weather, May to November.

A botanical survey of the mountain was made, at my request, by Professor Greene of the University of California in 1893, and a sentence from his report* exhibits the integral, as it were, of many separate conditions:

> . . . Mount Hamilton having been chosen as the site of the Lick Observatory on account of its being a fair-weather mountain . . . it must be interest-

* *Erythea*, vol. I, No. 4, April, 1893, page 77.

ing to note how well the native vegetation . . . would have indicated to the botanist the relative immunity of this mountain-top from fogs and long-continued rains.

Professor Greene finds that the species of trees, etc., on Mount Hamilton are nearly always those of the dry interior of the State rather than those of the coast ranges, and that the botanical region has its affinities with the dry San Bernardino mountains rather than with the peaks of the coast range lying very much nearer to it.

Purity of the atmosphere at Mt. Hamilton: North winds, in summer, bring dust from the Sacramento valley to surround us, and forest-fires near us, or even those of Oregon, sometimes fill the whole atmosphere with haze. When neither of these hindrances is obvious, that is for a very large proportion of the days, the air is of great purity. Two obvious proofs of it may be cited. The sky-glare near the sun is weak; and the atmospheric spectrum at sunset is beautifully clear and finely graded. Nearly all our summer sunsets are cloudless. The sky is a deep orange near the horizon and shades off through the prismatic colors, in a vertical circle, to the pure upper blue. No one who has seen this effect once will forget it, and to mention it will recall it to all who have lived with us. The photographs of sunsets at Mount Hamilton made by Mr. Colton * show the sun sinking into banks of dust or fog, not into clouds (consult the accompanying table of zenith-distances)

Daytime observations: All our experience at Mount Hamilton goes to show that the steadiness of vision in the daytime is certainly no better than that of American observatories generally, and that it is, probably, somewhat less good, though the difference is not very striking. The reason is twofold. In the first place the topographical situation of the observatory, surrounded as it is on all sides by steep slopes, exposes the instruments to whatever ascending currents of air there may be far more than if the observatory plateau were larger. This is a cause which can never be removed.

In the second place the slopes which immediately surround the plateau are composed of fragments of bare rock, which become intensely heated during the day, and whose radiations seriously affect the seeing. This cause can be done away with by planting trees and sowing grass and vines over the rock slopes. Experiments in this direction were urged on the Lick Trustees in 1881 and subsequently; and were begun in 1888. A considerable amount of water is needed in our excessively dry, and long, summers to prevent ordinary grasses from dying by drought, and there has been no adequate quantity of water available for this purpose. The (rain-water) reservoir capacity was considerably increased during the summer of 1895, and some water

* *Contributions from the Lick Observatory,* No. 5.

can now be spared for such experiments. Even if they are only partially successful the conditions of daylight vision will be improved.

Observations which can be made at almost any hour of the day (as spectroscopic and photographic observations of the sun) can usually, by diligence, be well made here, by choosing the best moments. The long series of solar photographs (many being excellent) obtained here by Mr. Perrine prove that such moments can be selected.

The negatives of the Transit of *Venus* of 1882 which were secured at Mt. Hamilton (by Professor Todd) are said to be the best of any which were measured at Washington.

Observations which must be made at a fixed instant (as meridian-transits of sun and stars) are, on the whole, not likely to be observed under as good conditions here as at the average observatory in the east. As the slopes of the plateau become covered with vegetation these difficulties will be in part removed, but in part only.

The effect of fog in the valleys on good vision: During my visits to Mount Hamilton in the years 1881 and subsequently I made careful notes of the conditions of good vision at the summit. The phenomena of an average summer day occur somewhat as follows: The sun rises in a clear sky, and no clouds are visible during the entire twenty-four hours. The days are hot (though, of course, not oppressive, since the air is exceedingly dry), and the vision during the day is usually unsteady on account of air-currents which rise from the neighboring cañons and from the heated rocks immediately bordering the plateau of the summit. The large valley of Santa Clara lies all day long in the ardent sunshine. Late in the afternoon the sea fog begins to creep in through the various gaps in the coast-range (which borders the Santa Clara valley on the west) and to come towards the north from Monterey Bay through the valley of the Pajaro River, etc. A local fog from the Bay of San Francisco often sends its thinner veils towards the south, but seldom extends as far south as Gilroy, where the Monterey fog is entering. Up to this time the fogs are low-lying. As the afternoon goes on the sea-fog rises higher and higher, and often pours over the tops of the highest peaks of the Coast-Range (3000 to 3800 feet), and completely covers the valley of Santa Clara, and fills our neighboring cañons close below us, but seldom (in summer) rises to our own level. Usually it is say 1000 feet lower. The hotel at the foot of the mountain has *frequent* fogs in summer (it is 2000 feet lower) when Mt. Hamilton has none.

The night fogs (in summer) seldom rise to the summit, and they are dissipated in the early morning.

As the autumn comes on the fogs rise higher and higher, and finally a day comes when the summit is covered. This is the precursor

of a change of season. This day may be followed by weeks of good weather, with only an occasional foggy afternoon and night.

Such is a very succinct account of the *average* summer day. There are exceptional days of fog at the summit, of no fog in the valley, and days when the trade-winds (which bring fog) are replaced by northers; but, in general, the above account represents the typical summer day. During all the summer the vision is, as a rule, steady, and for very many days it is remarkably so. If 3 represents the average seeing of the year (on a scale of 1 = very poor, to 5 = perfect steadiness) the days of June and early July are apt, in the long run, to be of grade 4, while late July, August, and part of September are of even higher excellence, and contain a considerable number of nights of perfect, or nearly perfect, seeing. In this brief account allowance must be made for exceptions, but, in the large, the course is about as just recited. If the seeing is good for part of a night it is usually good throughout.

In seeking for a cause of the excellent conditions of vision which prevail here during the summer nights, it appeared to me to be largely due to the banks of fog which lie over the Santa Clara valley. During the day that valley and our surrounding foot-hills, etc., are intensely heated. The thick layer of fog which often covers them from sunset onwards acts as a screen to shut in the radiations, and to allow the higher summits (as Mt. Hamilton) to quickly cool, and to take the temperature of the superincumbent air.

There is no doubt whatever that our best nights usually follow days when the fog has covered the valleys (though there are exceptions). The very best vision is usually accompanied by calms or very light airs. There is no doubt whatever that when we can see the electric lights of San José some thirteen miles away and 4000 feet below us (and thus when there is no fog) the nights are usually not of first-class excellence (though there are exceptions).*

During the years 1881–88 my stays at Mt. Hamilton were seldom so long as a month. The exceptional cases did not then impress me, and I was disposed to attribute the excellence of our summer vision almost entirely to the presence of the low-lying sea fogs. I still think that they are the principal factor; but an experience of actual residence during the years 1888–1896 has proved to us all that the explanation

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* When the lights of San José can be seen they are usually very unsteady, as might be expected, and the vision at Mount Hamilton is usually not good, as I have said. There are, however, occasions when the San José lights appear quite steady and yet are clearly seen; and on such occasions the vision at Mount Hamilton is usually good, though seldom perfect. The latter conditions are usually accompanied by a calm.

is not so simple, and that other conditions—perhaps many other—enter as efficient factors. Some of these factors are elsewhere considered.

The effect of wind on good vision at Mt. Hamilton: In comparatively level regions (as at Caroline Island in the midst of the ocean, at Washington, and at Madison), my experience has been that winds, even high winds, did not affect the seeing unfavorably. The general horizontality of air-strata of equal temperature is not affected under such circumstances, and local pockets of hot or cold air are broken up.

In his *Report* of 1879 Professor Burnham concludes that high winds at Mt. Hamilton do not affect the seeing unfavorably. My own experience does not agree with this conclusion. High winds at Mt. Hamilton (owing to the topography) produce currents of very varying directions, and prevent a stable arrangement of the air-strata, and the effect on the vision is, in my experience, often quite marked, and this without any exception that I can recall.

Vision at Mt. Hamilton during the presence of auroras: Professor Campbell has shown that the auroral line is pretty constantly present in the sky-spectrum, though auroras are seldom visible (here) to the eye.

Whenever they are so visible, the images of stars are invariably bad. This connection was even more obvious at the Washburn Observatory. It was easy to predict from a peculiar appearance of stars in the $15\frac{1}{2}$-inch equatorial that my assistant would see an aurora from the north window of the dome, and the predictions were made and tested on scores of occasions. At Mt. Hamilton visible auroras, intense neuralgic headaches, and poor stellar images seem to depend on one and the same cause.

Winter observing weather at Mt. Hamilton: The conditions during Mt. Hamilton winters are so markedly inferior to those which prevail during the summer, that the observers here are apt to underrate them. In a general way I think it is true that the winters at Mt. Hamilton afford as many clear days and as many days of good steady vision as those of Madison, Ann Arbor, or Cambridge. One winter may differ greatly from another in this respect, but on the average the foregoing statement (which is based on impressions and not on statistics) will probably hold good.

Comparison of different years at Mt. Hamilton: A glance at the complete meteorological statistics of Mt. Hamilton (elsewhere printed), will exhibit the great difference between different years taken as a whole. The summers are apt to be much alike, though they, also, vary. The winters vary in an extraordinary fashion. The total snow-fall of the winter of 1889–90 was about 12 feet; that of 1890–91 about $14\frac{1}{4}$ inches. The average *yearly* rainfall is 33.18 inches.

The rainfall for the month of December, 1884, was 33.8 inches! The following summary of rainfall and temperature observations will be found interesting and instructive:

SUMMARY OF RAINFALL AND TEMPERATURE OBSERVATIONS FROM SEPTEMBER, 1880, TO NOVEMBER, 1893, INCLUSIVE, AT THE LICK OBSERVATORY [COMPILED BY C. D. PERRINE]. *

Month.	Average Rainfall.	Temperature (Fahr.).					
		Average Maximum.	Average Minimum.	Mean.	Highest Maximum on Record.	Lowest Minimum on Record	Average Daily Range.
	inches	°	°	°	°	°	°
July	0.00	79.2	60.6	69.9	94	36	18.6
August	0.01	80.0	63.3	71.7	96	39	16.7
September	0.30	73.5	56.1	64.8	93	30	17.4
October	1.44	62.9	46.9	54.9	88	25	16.0
November	2.56	56.2	41.5	48.9	88	26	14.7
December	9.06	49.7	36.3	43.0	72	17	13.4
January	3.85	48.4	36.6	42.5	72	14	11.8
February	4.31	47.9	33.6	40.7	74	12	14.3
March	5.62	51.0	37.0	44.0	80	18	14.0
April	3.68	58.5	37.1	47.8	82	21	21.4
May	1.76	64.0	46.9	55.5	90	28	17.1
June	0.59	70.0	51.1	60.5	92	31	18.9
Annual	33.18	61.8	45.6	53.7	....	....	16.2

The following short table exhibits the facts as to the humidity of the air at Mount Hamilton. During the favorable months for observing, the air is usually extremely dry:

RELATIVE HUMIDITY AT 9 P.M. (100 = COMPLETE SATURATION).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1893	52	80	86	76	61	49	46	55	84	86	66	65
1894	78	78	76	55	74	72	37	33	52	59	47	90
1895	82	58	75	65	59	35	44	55	51	55	58	65

The best possible tests of the condition of the atmosphere are to be had from actual astronomical observations. It may be of interest to recall a few made at Mount Hamilton during the years 1888–1896 which exhibit either the transparency or the steadiness of the atmosphere.

Separation and measurement of close double-stars: The long series of

* *Publications of the Astronomical Society of the Pacific*, vol. VI, p. 47.

observations of Professor Burnham * should be referred to in this connection.

Detection of very faint stars: The observations of Professor Schaeberle and myself on the stars in the *Lyra* nebula,† and of Professor Barnard on the stars of the trapezium of Orion ‡ show stars of the last degree of faintness.

Observations of the structure of nebulæ: Reference should be made to papers by Schaeberle and myself § on the *Lyra* and *Draco* nebulæ.

Observations of faint satellites: The faint satellites of *Mars* are observed here as easy objects. They have been seen when their brightness was but 0.12 of that at the time of their discovery in 1877.‖ The fifth satellite of *Jupiter* was discovered here by Professor Barnard.¶

Observations of the Zodiacal Light: Professor Barnard's observations of the zodiacal light are noteworthy.**

Observations of comets: The observations of the faint companions of Brook's comet (1889, V) by Professor Barnard are especially instructive. They were discovered with the 36-inch equatorial and two of them (D and E) were seen, I believe, at no other observatory. The 12-inch refractor here was never able to show the fainter companion comets †† which is a fact of importance.

Definition of the surface features of the planets Mars, Jupiter, and Saturn: A long series of drawings of these planets by Messrs Schaeberle, Keeler, Barnard, Campbell, Hussey, and myself ‡‡ shows details of surface features in a very satisfactory manner. The bright projections at the terminator were first discovered and measured with the 36-inch telescope §§ and the fine division of the outer ring of *Saturn*, discovered by Professor Keeler in 1888, was not detected elsewhere.‖‖

Nothing could be more satisfactory than the observations of the phases of the eclipses of *Jupiter's* satellites, first regularly observed here. ¶¶

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* *Publications of the Lick Observatory*, vol. II.

† *Monthly Notices*, R. A. S., vol. XLVIII, p. 383.

‡ *Publications of the Lick Observatory*, vol. II, p. 48.

§ *Monthly Notices*, R. A. S., vol. XLVIII, pp. 385, 388.

‖ *Astronomical Journal*, No. 178.

¶ *Ibid.*, No. 275.

** *Ibid.*, No. 243.

†† *Astronomische Nachrichten*, No. 2919, and *Publications of the Astronomical Society of the Pacific*, vol. II, (1890), p. 26.

‡‡ *Publications of the Astronomical Society of the Pacific*, various vols.

§§ *Ibid.*, vol. II, p. 248; vol. VI, p. 103; vol. VI, p. 285.

‖‖ *Astronomical Journal*, No. 192.

¶¶ *Publications of the Astronomical Society of the Pacific*, vol. III, p. 263.

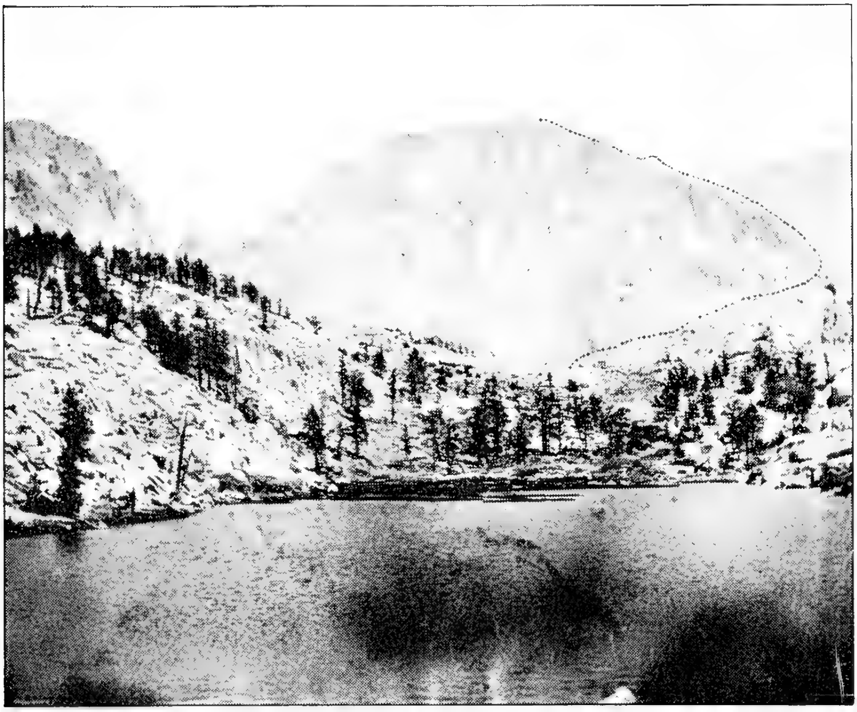

FIGURE 18:—MT. WHITNEY (14,900 feet), FROM THE WEST.

Markings on the discs of *Jupiter's* satellites have been systematically studied.*

Precise determination of star-places: Mr. Tucker's observations of star-positions (not yet published) extend over $2\frac{1}{2}$ years, and comprise about 5000 determinations of some 300 stars. The probable error of a single R. A. is $0^s.020$; of a single Decl. $0''.25$.

Photography of the Moon, Milky-Way, and Comets: The photography of the Moon,† Milky-Way, ‡ and of Comets, § and photographic-photometric ‖ experiments have been very successfully carried on here, under highly favorable conditions.

Photography of the Sun: More than 1700 negatives of the sun have been made at Mt. Hamilton by Mr. Perrine with the 40-foot photoheliograph. The best of them are extremely good, showing fine detail in the spots and of the faculæ, and permitting a subsequent enlargement of some 6 diameters. The average negative shows considerable detail. There is no doubt, however, that much of the excellence of this long series arises from the care with which the best moments for observation have been chosen, and that the average negative exhibits something better than the average seeing.

Spectroscopic observations: Good definition of star-images and great transparency of the air are powerful aids to spectroscopic observations, both visual and photographic.

Professor Campbell's spectroscopic observations have resulted in a catalogue of 37 lines in the spectra of different nebulæ. ¶

Likewise, the Lick Observatory observations of comet-spectra record 32 bright lines.**

The new star of 1892 (*Nova Aurigæ*) showed 32 lines in its visual, and about 50 lines in its photographic, spectrum to Professor Campbell, against a materially less number elsewhere catalogued. ††

Nineteen lines were registered in the spectrum of *Nova Aurigæ* in August to November, 1892, after the change in the spectrum.‡‡

The nebulous character of *Nova Normæ* was determined §§ when its altitude was less than $2\frac{1}{2}°$; and both bright and dark hydrogen lines

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* *Publications of the Astronomical Society of the Pacific*, vol. III, p. 359.

† *Publications of the Lick Observatory*, vol. III.

‡ *Astrophysical Journal*, vol. II, p. 58, and elsewhere.

§ *Knowledge*, 1891, p. 229; *Astronomy and Astrophysics*, 1893, p. 937; *Publications of the Astronomical Society of the Pacific*, vol. VII, p. 161.

‖ *Contributions from the Lick Observatory*, No. 3.

¶ *Astronomy and Astrophysics* for May and June, 1894.

** *Publications of the Astronomical Society of the Pacific*, No. 31.

†† *Ibid.*, No. 26.

‡‡ *Ibid.*

§§ *Astronomy and Astrophysics* for April, 1894.

were found in the spectrum of γ *Argus* when its altitude was less than 6°.*

The probable-error of a single observation of the velocity in the line of sight of a star like *Arcturus*, for example, is certainly not above 0.35 mile per second. The probable-error of the determination of the wave-length of the chief nebular line is 0.03 tenth-metre.†

Motion of Nebulæ in the line of sight: The determination of the motion of nebulæ in the line of sight was first made at Mount Hamilton by Dr. Keeler.‡

The preceding summary of results actually attained is the best possible testimony to the suitability of the astronomical conditions which prevail at Mt. Hamilton. Almost all departments of practical astronomy are represented by long series of observations, and in nearly every department the actual achievement is satisfying.

During the year 1888 I requested Professor Barnard to keep a record of the *steadiness* (only) of the vision at Mt. Hamilton on a scale of 1 = images extremely unsteady, 3 = average steadiness, 5 = images perfectly steady, and this record will subsequently be published by him.

Dr. Langley's Expedition to Mount Whitney (14,900 feet).

The expedition of Dr. Langley to the summit of Mount Whitney in the summer of 1881, presents an excellent example of the advantages which mountain-stations sometimes afford for the prosecution of special researches in astronomy or astronomical physics. §

The particular object of Dr. Langley's expedition was to determine the *solar constant*, that is to evaluate the quantity of radiant heat received from the sun by the outer layer of the earth's atmosphere in a unit of time (as the quantity falling on each square centimetre per minute).

This determination involves an investigation of the selective absorption of the earth's atmosphere at two stations near to each other but differing greatly in altitude. And it is further indispensable that the sky should be clear and dry at both stations.

Mount Whitney in Southern California fulfilled all the required conditions admirably.

Its summit is 14,900 feet in altitude, so that about one-third of the earth's atmosphere lies beneath its level. The mountain is very abrupt, so that the lower station, at Lone Pine (about 3700 feet),

* *Astronomy and Astrophysics* for June, 1894.

† *Publications of the Lick Observatory*, vol. III.

‡ *Ibid.*

§ Dr. Janssen's observations to detect the presence of oxygen in the sun, made at Chamounix and on Mont-Blanc, are a case in point.

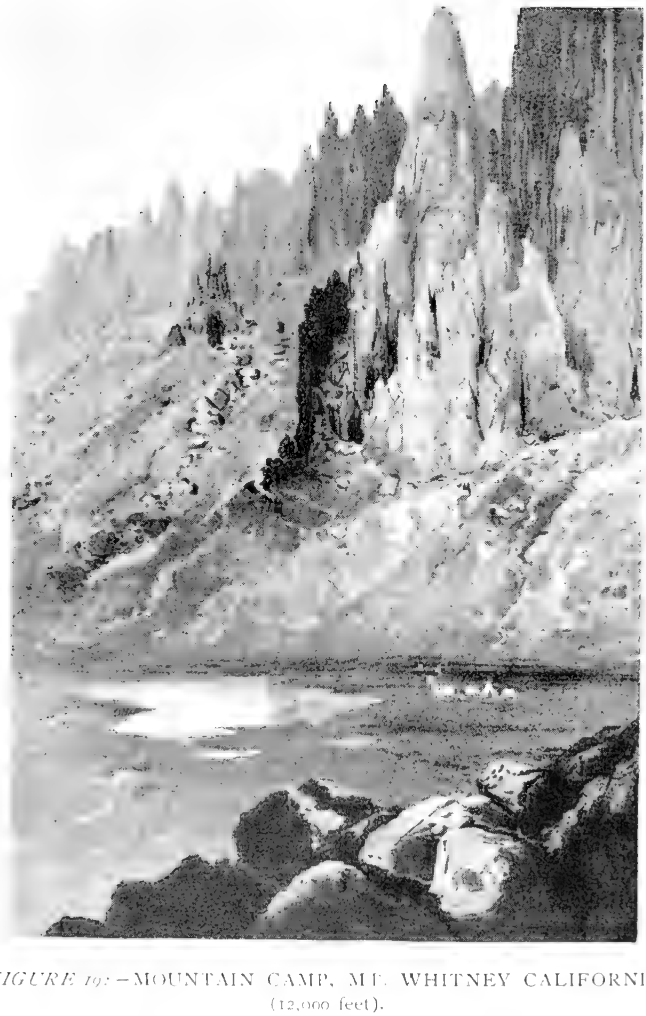

FIGURE 19: — MOUNTAIN CAMP, MT. WHITNEY CALIFORNIA, (12,000 feet).

was close to the upper one, and in full view from it. Much of the work was done at a third station, "Mountain-camp" (12,000 feet). No point east of the Sierras possesses equal advantages for the particular (solar) work referred to. The high peaks in the Rocky Mountains, while admirable as meteorological stations, and comparatively very accessible (Gray's Peak, Pike's Peak, Mt. Lincoln, and many others), are much affected by mist and cloud. Many stations in the Sierras and in other ranges in California and neighboring States are entirely suitable, but as Mount Whitney was the highest and most southerly of the great peaks it was chosen.

On the recommendation of Dr. Langley, seconded by a Committee of the National Academy of Sciences, the Congress of the United States has reserved from sale a considerable area, including the summit and surroundings of Mt. Whitney, so that this station will be forever available for the study of physical problems. A railway passes near the foot of the mountain, and a comparatively small expenditure would open practicable trails for baggage animals to the Mountain-Camp above mentioned. During summer there is comparatively little snow even at the highest part of the mountain mass.

Mt. Whitney has, thus, many advantages as a high-level station for meteorological and special astrophysical researches. It should be borne in mind that its summit is but 880 feet lower than Mt. Blanc; and especially that it is very easy of ascent as far as 12,000 feet. The summit itself, some 3000 feet higher, can be reached in about three hours from the mountain-camp.

From Dr. Langley's notes I extract a few sentences bearing on the astronomical conditions on Mt. Whitney:

> August 16. The sky to-day, as always, is of the most deep violet-blue, such as we never, under any circumstances, see at the sea-level. It is absolutely cloudless, and there is only a slight orange tint about the horizon at sunset. Carrying a screen in the hand between the eye and the sun, till the eye is shaded from the direct rays, it can follow this blue up to the edge of the solar disc without finding any loss of this deep violet or any milkiness of the sky as we approach the limb. It is an incomparably beautiful sky for the observer's purposes, such as I have not seen equalled in the Rocky Mountains, in Egypt, or on Mt. Etna.

It is perfectly safe to add to Dr. Langley's enthusiastic testimony that there are literally hundreds of stations in California and the neighboring States of equal altitude with his mountain-camp (12,000 feet) where equally satisfactory observing conditions prevail, so far as transparency is concerned.

Dr. Langley's remarks above relate principally to the *clearness* of the sky. Its *steadiness*, as judged by the absence of twinkling of the

stars, etc., was not thoroughly tested. Such tests as could be made are, however, spoken of as satisfactory.

Further tests of the clearness, the transparency, of the air proved to Dr. Langley's that the atmosphere above 12,000 feet still contained a considerable amount of dust. This dust-shell exists all over the world, in Europe, Asia, and America, and it extends considerably above 12,000 feet, though by far the greater portion of it is within 2000 or 3000 feet of the earth.

The smoke from forest-fires in the neighborhood also did its part. In spite of these drawbacks the sky at the summit and at the mountain-camp always showed itself very much more transparent than at the various stations in the Rocky Mountains or in Europe which Dr. Langley had previously occupied. Even the station at Lone Pine had a sky much purer than that seen at the Allegheny Observatory, except on rare occasions.

During the dry season in California the weather is likely to be fair for months at a time (May to October).

After an experience of some two months on the mountain, Dr. Langley sums up as follows:

> I hope I have made plain my own belief that Mount Whitney is an excellent station for the purpose for which it was chosen. The great drawback in our case was the inability to remain permanently at the very summit, for to do this requires a permanent shelter. But a railroad will shortly run through Inyo Valley,* and from this, by the aid of an easily constructed mule-path, the ascent of the very highest peak can be made in a day, while the telegraph will put it in direct communication with Washington. I do not think the Italian Government in its observatory on Etna, the French in that of the Puy de Dome, or any other nation, at any other occupied station, has a finer site for such a purpose than the United States possess in Whitney and its neighboring peaks, and it is most earnestly to be hoped that something more than a mere ordinary meteorological station will be finally erected here, and that the almost unequalled advantages of this site will be developed by the Government.

Stations in Colorado Occupied by the Harvard College Observatory.

In 1887 the Harvard College Observatory became possessed of the Boyden Fund, left by Mr. Boyden to aid in the establishment of an observatory "at such an elevation as to be free, as far as practicable, from impediments . . . due to atmospheric influences." In 1887 the Harvard College Observatory sent an expedition to occupy various stations in Colorado. A 12-inch equatorial was set up at three stations —namely, Colorado Springs (6035 feet), Seven Lakes (10,964 feet),

*It is now in operation.—E. S. H.

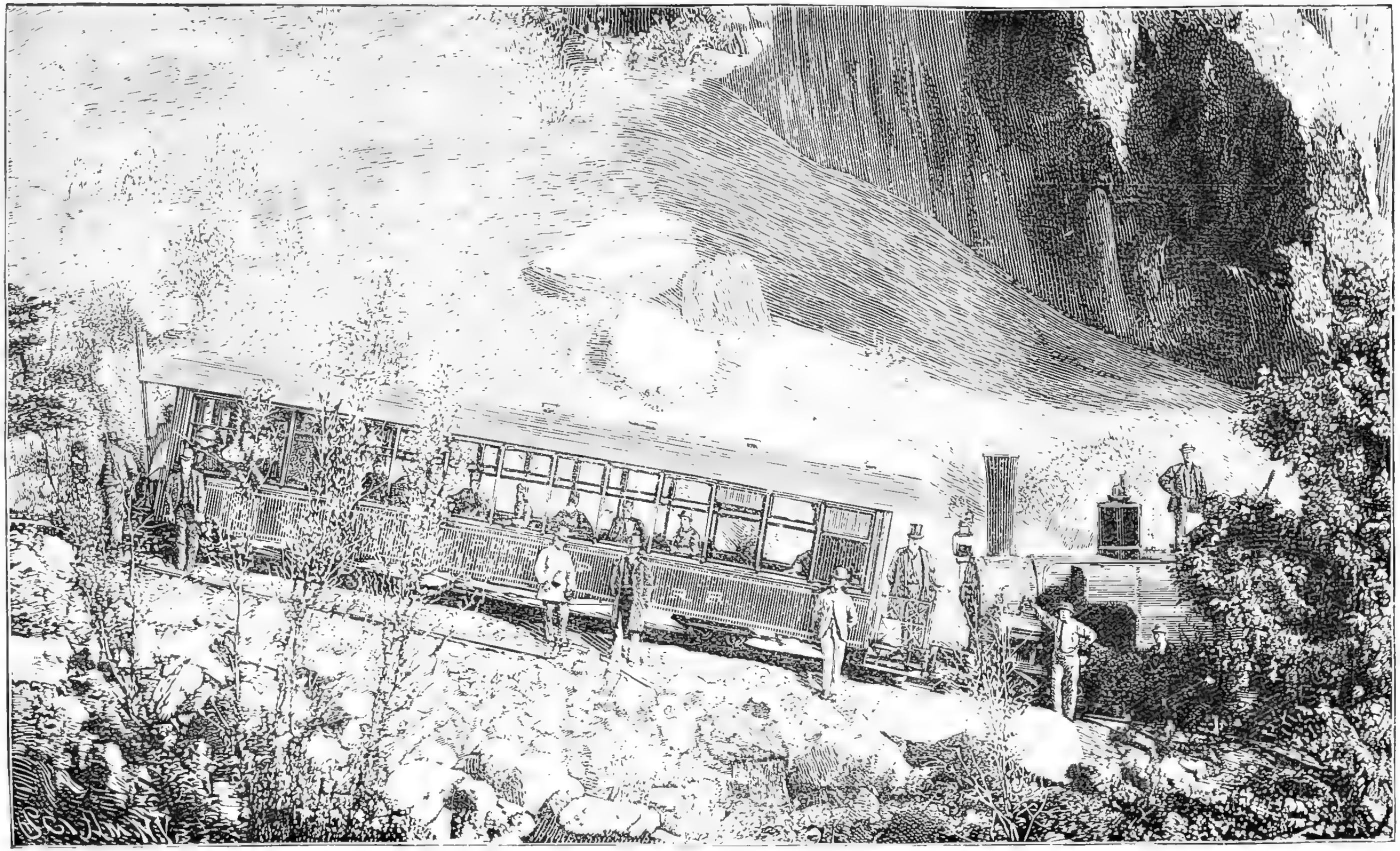

FIGURE 20.—VIEW OF THE RAILWAY TO THE SUMMIT OF PIKE'S PEAK.

and on the summit of Pike's Peak (14,147 feet). Stations at Mt. Lincoln (14,200 feet) and vicinity were also examined.

Professor William Pickering reports that "with regard to the steadiness of seeing no appreciable advantage over Cambridge was shown at any of the stations. The skies were undoubtedly somewhat clearer."

THE METEOROLOGICAL OBSERVATORY ON PIKE'S PEAK (14,134 FEET).

The *Annals* of the Harvard College Observatory, vol. XXII, 1889, contain very complete series of meteorological observations during fourteen and a half years (1874–1888), compiled by Professor H. A. Hazen. As this was for many years the highest meteorological station in the world (Leh, Ladakh, being 11,503 feet, the Sonnblick 9843 feet), it will be of interest to give a short summary of the different tables.

In the first place it is well to remark that the station was continuously occupied, without accident, for fifteen years, from October, 1873, till September, 1888. A telegraph line from the summit to the town of Colorado Springs, some ten miles distant and 8000 feet lower, was maintained for a considerable portion of this time. It may be added in this place that a railway was completed to the summit in June, 1891, and that it is regularly operated for the benefit of tourists during the summer. The running time from Manitou (6563 feet) to the summit station (14,115 feet) is an hour and a half, and the fare is $5. The distance from Manitou by rail is 8 miles. The maximum speed is 8 miles, the minimum 3 miles per hour. Here we have a station which can be constantly occupied, is very accessible, and only 1646 feet lower than Mont Blanc. Mountain-sickness does not affect observers permanently stationed there.

The mean temperature of Pike's Peak is about 19° F. The highest observed temperature was 64° and the lowest—39°. The daily range of temperature is never large, the maximum being about 14°.

The average velocity of the wind is high, but by no means excessive; the average hourly velocity being about 27 miles for January, 12 for July.

Severe and prolonged wind-storms are unusual, and the days when the mean hourly velocity equals or exceeds 50 miles are comparatively infrequent. The most remarkable wind-storms on record were those of September 28–29, 1878, when the mean velocity for 24 hours was 71 miles, and December 25, 1883, when the mean velocity was 70 miles per hour. The highest extreme velocity recorded was 112 miles.

The mean annual cloudiness on Pike's Peak is 40 per centum, ranging from 33 per centum in November to 74 per centum in July.

The electrical storms at the summit are fully described by the observers, and they are terrific. By taking proper precautions they are not dangerous to life, though most appalling. The lightning is nearly continuous for long periods, and the deep rolling thunder is shattering to the strongest nerves.

I myself witnessed one of these storms in 1873 from a safe shelter at the foot of the mountain, and I shall never forget it. Columns of lightning seemed to *stand* in place for minutes, and the rolling of the thunder was awful to hear. No amount of reason could prevent the instinctive shrinking from the sudden bursts of lightning and the deafening reports and echoes of the thunder. The observers on the mountain summit were much incommoded by these electrical storms, but learned how to arrange their telegraph instruments, etc., so as to avoid all real danger.

Hailstorms on the mountain are frequent and violent. Snow falls in every month of the year, but not in such quantities as to make work specially difficult.

The extraordinary transparency of the atmosphere at the summit has been remarked by all who have had occasion to test it. The following extract from the journal of the observers is a proof of it:

October 9, 1874. The atmosphere was so transparent that with the aid of a telescope the observer could see the low range of hills on the line of New Mexico (about 130 miles), and the southern portion of Wyoming (about 150 miles); could also distinguish houses and streets in Pueblo (distant 50 miles); and had a fine view of Denver (which is over 75 miles away).

Such an atmosphere as this is perfect for certain astrophysical observations. Unfortunately the *steadiness* of the atmosphere leaves very much to be desired, as is testified to by all observers who have spent any time on the summit.

In July, 1878, Dr. Langley observed the total solar eclipse from the summit of Pike's Peak. He reports that the summit is probably not a suitable station for a large telescope, and concludes that "a somewhat lower station sheltered from the vapor-bearing winds would be much better than the peak itself," say at an elevation of from 8000 to 11,000 feet. He remarks upon the great transparency of the air, and on one occasion was struck with the steadiness of definition.

The party of Professor Langley was much affected by mountain-sickness, and it was necessary for one of them, Professor Abbe, to descend to a lower level, as a physician pronounced his life to be in danger if he remained on the summit.

In 1893 Professor G. E. Hale (H.), Mrs. Hale (L.), and Professor Keeler (K.) went to Colorado to attempt to photograph the solar corona from the summit of Pike's Peak (14,134 feet). The journal of

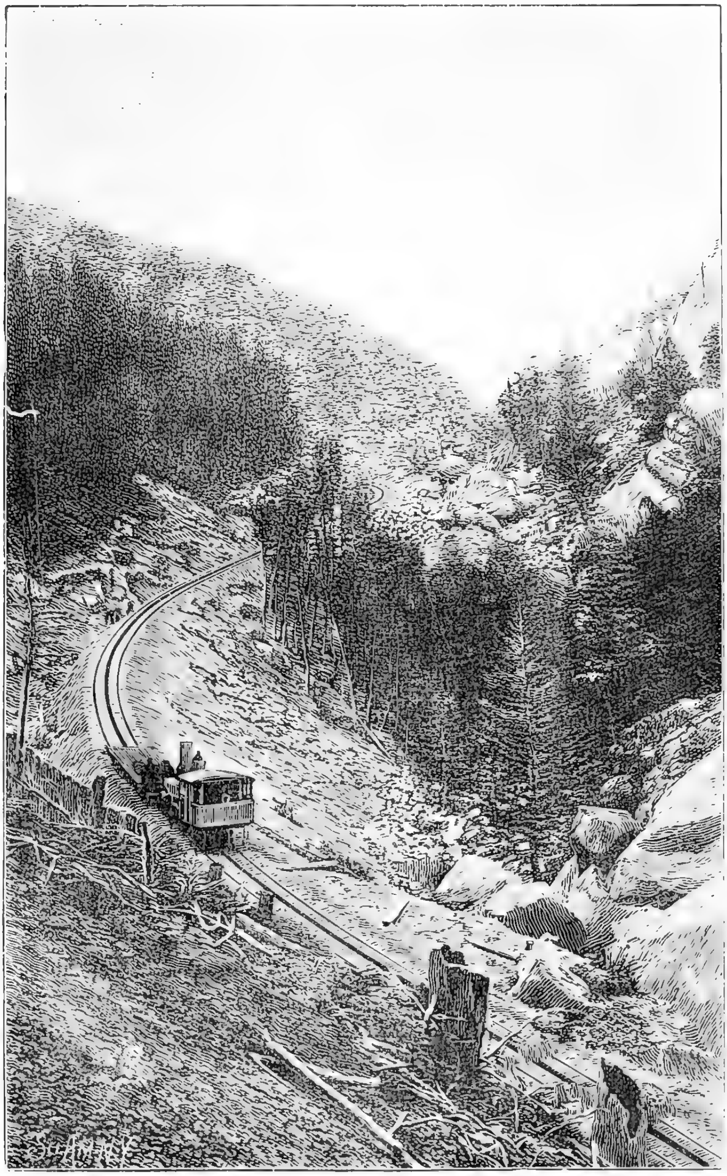

FIGURE 21.—VIEW OF THE RAILWAY TO THE SUMMIT OF PIKE'S PEAK.

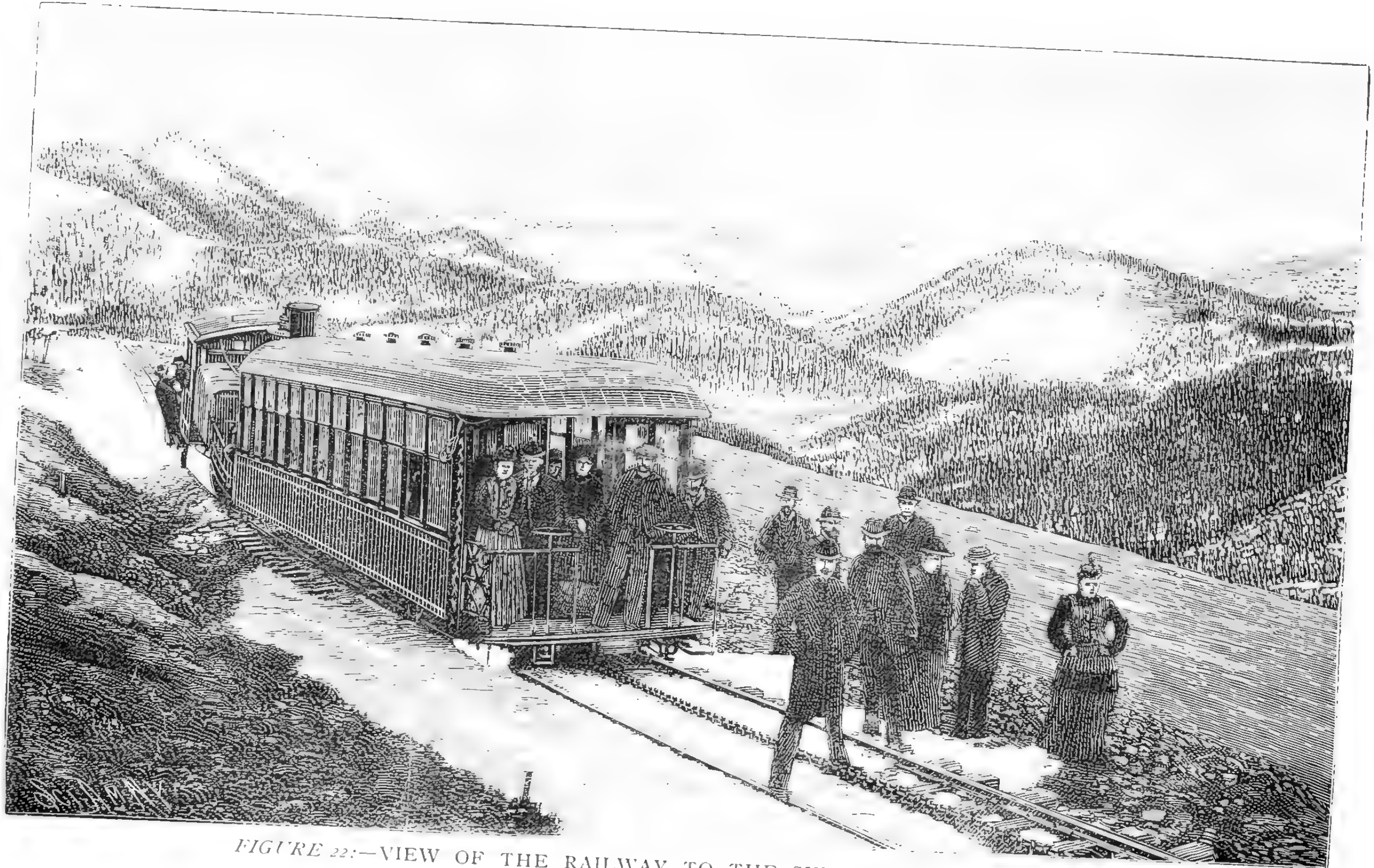

FIGURE 22:—VIEW OF THE RAILWAY TO THE SUMMIT OF PIKE'S PEAK.

their expedition is interesting on many accounts, and it is especially so when compared with a corresponding journal kept at the summit of Mt. Blanc.*

Mr. Hale's diary (in part) is:

1893, June 20: "Went up the peak in the morning train, taking a trunk filled with apparatus and the stand for the telescope. L. and H. returned (P.M.) to Manitou" [*i. e.* to a comfortable hotel].

June 21: "Went up on the morning train." "Suffered considerably from headache due to the altitude."

June 22: "L.'s severe headache continued to grow worse, and it became impossible for her to stay on the peak." "H. and L. went down P.M."

June 23: "H. went up on the morning train."

June 24: "A snow-storm came up, so H. and K. went down on P.M. train," etc.

This going up and down from the summit on trains whenever any obstacle to work occurred presents a lively contrast to the adventures of the party engaged in digging the snow tunnels on Mt. Blanc, with the grim entries: "A tourist and a guide killed by an avalanche" to-day—"Dr. Jacottet died to-day on the summit." When it is remembered that the uses of very high mountain peaks in astronomical observations are *occasional* and not *continuous* (for the solution of special problems, not for consecutive routine observations), the advantage of choosing such a station as Pike's Peak is obvious.

Professor Hale's notes on the weather at the summit should be consulted in his original paper. He found the blueness and purity of the sky interfered with by smoke from forest-fires, and on two occasions by great swarms of insects:

A word as to the suitability of Pike's Peak as a site for astronomical observation. When free from the disturbing effect of forest-fires the sky is of a deep blue at the zenith, and when the conditions are very favorable the blueness persists up to within a short distance of the sun, losing, however, much of its depth of color. During the entire time of our stay the stars appeared to be little or no brighter when seen from the peak than when seen from Manitou, 8000 feet below.†

The scintillation, even near the zenith, was always very marked, and at no time during our stay would the seeing have been even fair. In this respect our experience agrees closely with that of the Harvard College Observatory party which visited the peak some years ago.‡

The altitude of the summit (14,147 feet) § is not greatly inferior to that of

* *See* an abstract of that journal in the present volume, page 26.

† The naked eye is not sufficiently delicate, nor the memory sufficiently retentive, to make a general observation of this kind very trustworthy. Observations of magnitude regularly conducted would have shown a distinct gain at the higher level, particularly for stars at low altitudes.—Note by E. S. H.

‡ And with my own observations of 1873, 1878, and 1885 made (not on the summit but) at various high stations on the flanks of this mountain and on others in and near the South Park.—Note by E. S. H.

§ 14,134 feet according to *Annals* H. C. O., vol. 22.—Note by E. S. H.

Mont-Blanc (15,780 feet), and the railroad which ascends from Manitou is a great convenience. For such observations as require a blue sky rather than good seeing, Pike's Peak (when not surrounded by forest-fires) would seem to offer some important practical advantages over other mountains of equal altitude. But if good seeing is essential the peak is not to be recommended.

Mountain-Sickness on Pike's Peak.

Professor Hale, 1893, reports that " about two-thirds of the tourists who came up the mountain on the train each morning were affected by the altitude,* and during our stay we saw one or two very serious cases of mountain-sickness. While not much troubled, Professor Keeler and I found prolonged hard work very fatiguing, and any slight extra exertion at once increased the action of the heart."

Mrs. Hale was unable to remain on the summit, although she, naturally, was not called on for any extra exertion there.

Most mountains are (for obvious reasons) quite cloudy (Pike's Peak, Mont-Blanc, etc., as examples). The great advantage of the mountains of California, Arizona, New Mexico, and Southern Colorado is their remarkable freedom from clouds. I have not been able to see any report of the conditions on the mountains of Algeria, but one would think, a priori, that they should be excellent.

Lowell Observatory, Flagstaff, Arizona (7300 feet).

In the *American Meteorological Journal* for March, 1895, Mr. A. E. Douglass, one of the staff of the observatory, gives a table with numerical estimate of the quality of the seeing (its steadiness) from September 28 to December 31, 1894, while he was conducting certain very interesting experiments on air currents within the tubes of large telescopes. These experiments were usually made only when the seeing had become too poor for other observations. The seeing (steadiness) is marked in eleven grades; the best is 10, the worst is 0. It is noteworthy that the seeing was worse than 6 on some part of 48 nights out of 51 nights recorded.†

The conditions at Flagstaff are, then, very different from those at Mount Hamilton (or Mount Wilson) where the whole night is apt to be good if any part of it is so. At Flagstaff it appears that a portion of nearly every night is unsatisfactory, and Mr. Douglass says that almost the entire month of December was so.‡

* The train takes 1 hour 45 minutes to rise from the station at Manitou (6563 feet) to the summit station (14,115 feet). The time required for the journey down is 1 hour 15 minutes. The maximum speed is 8 miles, the minimum, 3 miles per hour.

† I have not counted the estimates for November 2, 3, 4, 5, and 9, where *two* estimates are given, one greater and the other less than 6.

‡ In this connection, see a letter by Professor W. H. Pickering in the section of this volume devoted to the Arequipa Observatory, page 40.

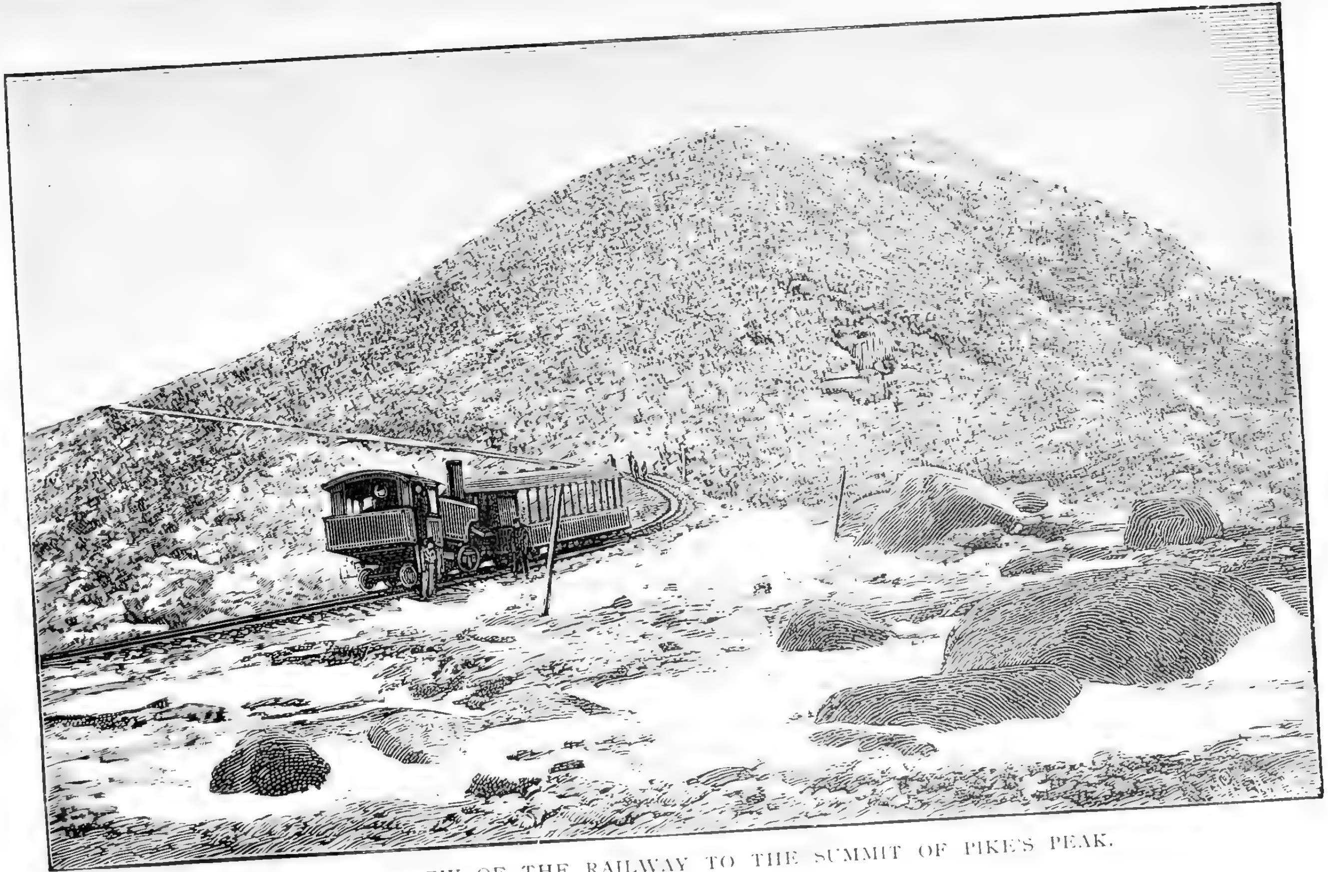

FIGURE 23:—VIEW OF THE RAILWAY TO THE SUMMIT OF PIKE'S PEAK.

FIGURE 24:—VIEW OF THE LOWE OBSERVATORY ON ECHO MOUNTAIN, (3,500 feet).

ECHO MOUNTAIN, CALIFORNIA (3500 FEET).

A private letter from Dr. Lewis Swift gives some statistics of the weather at Echo Mountain which I quote:

Between April 20 and December 1, 1894, there was only one rain of any amount, and during that time the cloudy nights have averaged about three per month. These statistics refer, of course, to the California dry season, the months December to April being much less favorable. But after making all deductions it is obvious that the number of clear nights at Echo Mountain is very much greater than at any observing station east of the Sierra Nevada. Echo Mountain (3500 feet) and Mt. Wilson (4700 feet) are reached by railway from Los Angeles and Pasadena. Mt. Lowe (6000 feet) will soon be accessible in the same way.

CHAMBERLIN OBSERVATORY (5400 FEET) NEAR DENVER, COLORADO.

Professor Howe, Director of the Observatory, in a letter of March 10, 1896, obligingly gives what data are available regarding the newly established observatory. From August 24, 1895, to March 1, 1896—189 nights—must be deducted 65 nights of which no record was kept, chiefly because the moon would interfere with comet-observations. Of the 124 nights remaining 71 were utilized for work:

I consider it safe to say that sixty per cent of the nights were clear. I believe the half-year from September to March is clearer than from March to September.*

My impression of the star-images is that there is more of dancing and shooting out of little arms than at lower altitudes, but less of blurring. On this account faint companions near bright stars are frequently hard to see. . . .

I do not think there are more than twelve or fifteen first-class nights in a year, but this is a matter of estimation rather than actual count.

The transparency of the atmosphere about Denver is well known to be remarkable, and is referred to by Professor Howe.

THE NATIONAL OBSERVATORY OF MEXICO (TACUBAYA) (ABOUT 7500 FEET).

On March 5, 1896, I addressed a letter to Director Anguino asking for data relating to the steadiness of star-images at Tacubaya, based on experience. From his reply of April 9th the following paragraph is quoted:

In respect to the second question, the problem is complicated for us, not only on account of the altitude, but because there is a local cause that perhaps has more influence upon the photographic images—that is, the movement of the dust constantly raised in the valley of Mexico.

As yet we can say nothing that would be well established, since it is a point which I am yet studying, but we can advise you as we advance farther in the study.

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* The clear half-year would be the period of unsteady images, so far as my personal observation in this region holds good.—Note by E. S. H.

So far as I have been able to ascertain from all inquiries, the astronomical conditions near the city of Mexico are not especially favorable. It is reported that Mr. Percival Lowell proposes to establish a 24-inch telescope in this vicinity during 1896. If this is done a good direct comparison with the conditions at Flagstaff, Arizona, can be had, and indirectly a comparison with Mount Lowe, Arequipa, and Mount Hamilton.

In December, 1895, a survey of the volcano Popocatapetl (nearly 18,000 feet in altitude) was made for the purpose of laying out an aërial cable railway to the summit. The object of the railway is to exploit the sulphur beds, but it will, no doubt, lead to the establishment of a high-level meteorological observatory.

CHAPTER IV.—SCIENTIFIC USES OF BALLOONS AND KITES.

Scientific Balloon Ascensions.

The first scientific balloon voyage was made (in London) by Dr. John Jeffries, of Boston, Massachusetts, in the year 1784.* The barometer fell to 21.25 inches (altitude about 9300 feet).

Some of the ascensions and the heights reached are noted below:

		FEET.
Gay-Lussac and Biot, 1804		23,000
Barral and Bixio, 1850	about	23,000
Welsh, 1852	"	23,000
Glaisher, 1862		29,000
Croce-Spinelli, Sivel and Tissandier, 1875	about	29,000
Berson, 1894		30,000

There are three ways in which balloons may be used for scientific observations—(*a*) as captive balloons at comparatively small heights; (*b*) in ascensions carrying observers; and (*c*) as free balloons bearing self-registering instruments, but no observer.

Captive balloons are convenient; but they cannot be sent to great heights, and, in general, it is difficult to keep them at a constant altitude while strong winds are blowing.

Balloons carrying an observer are enabled to obtain the most trustworthy results, but the heights which they command are limited to some 20,000 feet.

Free balloons, carrying only self-registering instruments, have lately been brought to great perfection, and an extreme height of eleven miles has been reached (18,450 *m*).

MM. Gustave Hermite and Besançon succeeded, in 1893, in sending a small balloon to the prodigious height of 52,500 feet (nearly ten miles). The weight of the whole apparatus was about 17 *kilos* (37.5 pounds), and a complete set of self-registering instruments was carried.

* The ascension of the brothers Montgolfier was made in 1782.

The balloon used by M. Hermite was made of goldbeater's skin —an extremely light material. A balloon of this construction, filled with 25,000 cubic feet of hydrogen, will, it is said, keep one man afloat for thirty days. Ordinary balloons have contained 100,000 or more cubic feet of (illuminating) gas, but they are not suitable for prolonged voyages. M. Hermite's balloon held about 4000 cubic feet, but it was filled with coal gas on this occasion. At the start the balloon had a lifting power of 143 pounds.

The balloon started from Paris at 12 h. 25 m. (noon), and after six and three quarter hours landed seventy-eight miles distant. The self-registers recorded automatically every five minutes. At 2.30 P.M. the balloon reached a height of 52,500 feet (nearly ten miles), and the thermometer was at —104° F. A table of the rate of decrease of temperature with increased height has been deduced from the observations, and it is very important. It is not necessary to quote this table here. It shows that the rate of change is more rapid near the earth than in the upper air. The average decrease of temperature was 1° F. per 313 feet.

Dr. Assmann of Berlin has also experimented with small balloons carrying self-registering meteorological instruments, and during the months May–July, 1894, several successful ascensions were made. The readings of the barometer were photographed. On July 7, 1894, the balloon reached an altitude of 53,560 feet, or over ten statute miles.

The greatest height so far reached by such balloons is 18,450 metres, eleven and a half miles. Balloon ascents for scientific purposes are regularly made in Berlin, using large balloons carrying one or two persons. Heights of 10,000–13,000 feet are frequently attained, and the military balloons of the German army are frequently employed in these ascensions. A famous ascent was made in the *Phœnix* balloon by Dr. Berson (December 4, 1894), starting from Strassfurt at 10.28 A.M. At 4200 metres unusual fatigue was felt after exertion; at 6000 metres slight *malaise;* at 6750 metres the breathing of pure oxygen gave relief; above 8000 metres (26,247 feet) oxygen was breathed constantly. Without it dangerous symptoms of dizziness and weakness manifested themselves. The highest point reached was 9150 metres (30,020 feet), at 12.45 P.M. The observer's general condition was good, and his opinion is that he could have gone higher had his store of ballast permitted. The only serious hardship was the extreme cold, — 47°.9 C. = – 54°.2 F. At 3.45 P.M. the balloon was brought to earth near Kiel, thus ending a successful journey—the highest recorded altitude having been reached.

The scientific problems to be solved by such voyages are manifold.

Among those directly affecting astronomical observations are the following:

(1) The rate of the diminution of temperature with altitude and the laws which govern it. The lowest temperature registered by Barral and Bixio (1850) was – 39°.7 C. (= – 39°.5 F.) at 7000 metres (= 22,966 feet). Gross and Berson (1894) found a slightly higher temperature (– 36°. 5 C.) at the altitude of 7700 metres (= 25,262 feet). A balloon carrying self-registering apparatus (but no observer), dispatched by Hermite (1893), recorded – 55° C. (= 58.9 F) at 14,000 metres (45,932 feet); and a similar balloon, sent by Gross and Berson from Berlin (1894), registered – 67° C. (– 88°.6 F) at about 18,500 metres (60,696 feet; 11.5 miles).

(2) The laws of the distribution of moisture in the atmosphere.

(3) The velocity of the winds of the upper air. The motion of the balloon last spoken of was about 33 metres (108.3 feet) per second.

(4) The pressure of the atmosphere.

(5) The physiological effects of increased altitude in balloon ascensions (which are made without marked physical exertions on the part of the observer, though not without mental anxiety, probably) have some bearing on the question of life and work at high mountain-stations.

From 3000 to 4000 metres (9842 to 13,123 feet) Biot and Gay-Lussac found the pulse-rate increased by some thirty per cent. Above 5000 metres (16,404 feet) difficulty of breathing and a desire to sleep are manifested. At 8000 metres (26,247 feet) Tissandier (1875) fell in a swoon, and when he awoke he found his two companions (Sivel and Croce-Spinelli) dead beside him.

The purely meteorological data to be acquired by balloon ascents need not be recited here, though they are of the first importance. Dr. Sohncke points them out (in an address delivered before the Royal Academy of Sciences at Munich) in detail, in connection with a brief sketch of the history of the development of our knowledge of the laws of the winds—a capital question. While much is known from pure mathematical and physical theory, from thousands upon thousands of observations at ordinary levels, and from very many at mountain-stations, this fundamental problem is not yet solved. In Dr. Sohncke's words, meteorology is at a standstill. The elevated stations on peaks have given much valuable information, but their data for the upper air are affected by the local topography and by the surrounding ground. The Eiffel tower is, in its way, an ideal high station, though its height is not sufficient.

In order to make further progress, recourse must be had to balloons —both with and without observers.

During the scientific balloon ascents from Munich, the neighboring mountain-stations of Hohenpeissenberg, Hirschberg, and Wendelstein made corresponding observations on many separate occasions. A discussion of all of these showed that in general the mountain temperatures were far from harmonizing with the temperature of the free-air as obtained from the balloon. The latter temperature is, however, that which is wanted for scientific purposes. It can only be obtained from the thermometer-readings at the high-level stations by applying empirical connections which are neither constant nor certain. The disturbing effect of the mountain masses cannot be fully eliminated. Further progress in scientific meteorology appears, then, to be dependent upon data obtained from a series of intelligently planned balloon ascensions, and this conclusion is growing among meteorologists.

Mountain-stations are not fitted to give all the data required of them. Their observations must in many cases be supplemented by records taken in balloons and in many cases it seems desirable to do away with the stations altogether and to depend solely on balloons. No doubt a given sum of money expended in such ascensions would result in a greater benefit to meteorology than if it were used to build and maintain a mountain-station.

Again, a mountain-observatory once established is fixed in position. Balloon ascensions, however, can be made from any chosen spot, and this constitutes a most important scientific advantage.

The conclusions here very briefly stated with regard to the relative advantage of balloons over mountain-observatories hold good also for observations made from *kites*, of which a word will be said. There can be little doubt that future advances in scientific and in practical meteorology (weather predictions, etc.) will be due in large measure to observations made from balloons and from kites, and that the establishment of a large number of permanent mountain-observatories is to be discouraged, both from a scientific and from a practical point of view.

Kites for Scientific Purposes.

Experiments with large kites, used singly or in tandem, have been made and heights of several thousand feet have been reached.

Self-registering meteorological instruments have been devised which are light enough to be lifted by this means.

Wherever there are strong winds this method of investigation promises to be as useful as it is simple and inexpensive, and with skill kites can be raised to the upper winds through almost dead calms below. Mr. W. A. Eddy has sent a single kite to about 1800 feet. At or before the time such an elevation is reached the string be-

comes too heavy to be lifted, and the method of using kites in tandem consists in lifting the string of the first kite by attaching it to a second. The string of the second kite can again be lifted by using a third, and so on. With nine kites a maximum height of about 5600 feet has been reached.

In strong winds kites have many advantages over captive balloons; and at all times either kites or balloons have some important advantages for meteorological observations over mountain-stations—particularly over high mountains which are covered with snow. Such stations are affected by exceptional local conditions. The snow itself affects the surrounding atmosphere sent up from a valley near a high mountain in a marked degree. A kite or a balloon would certainly experience different conditions from those prevailing about the mountain summit.

Again, mountains suitable for observing stations are not to be found everywhere—whereas balloons and kites can be sent up from any station.

It ought not be forgotten that the first scientific kite-flying was done by Benjamin Franklin so long ago as 1752.

APPENDIX.—Bibliography.

[Note.—The following bibliography is not complete, nor is it intended to be so. The references here given are the most important ones; and by following them up in the original works the reader will find himself on the track of others not here printed.]

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A BIBLIOGRAPHICAL DESCRIPTION

BY

P. LEE PHILLIPS

CITY OF WASHINGTON

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A BIBLIOGRAPHICAL DESCRIPTION

BY P. LEE PHILLIPS.

"*Maps may without exaggeration be called the light or eye of history.*"—*Hulsius.*

THE MAP OF 1585 AND ITS AUTHOR, JOHN WITH.

No record of the past has suffered more from the wear and tear of time than maps. When published separately they usually find their way into the waste-basket, the old ones being supplanted by new editions; and, if inserted, to illustrate a volume of text, they have been placed either in the front or back, an easy prey to the destructive hands of careless readers.

In this country the importance of maps has until recently been little appreciated; few libraries can boast a good collection, and the ones they have are so carelessly indexed that they are mostly inaccessible.

When a thought is given to the inestimable value of authentic historic data, there is reason to regret and wonder why maps should not receive the care in keeping with their importance.

How many volumes of great rarity in our libraries would be made doubly so, if the much too frequent "wanting map" could be returned to its domicile!

The literary hobbyist, or I should rather say the uneducated vandal, who, anxious to collect all on a given subject, will slash and destroy whatever is not in his line, is responsible for much labor to the bibliographer, for in preserving the map alone he has made it difficult to identify its past history.

To remedy some of these evils, especially in connection with Virginia—a portion of North America which in early days embraced much of that which is now known as the United States—is the object of the following monograph.

Before beginning, it may be well to remind the reader that it required many years for a trustworthy survey to be made of such a distant country as America; in the meantime, the imagination of the old cartographers ran riot, and maps of this continent look more like illustrations of Noah's ark, with abundance of water, quaint animals and birds, than serious contributions to history.

Let us illustrate this statement in an anecdote told by Sir Walter Raleigh.

"I remember a pretty jest of Don Pedro de Sarmiente, a worthy Spanish gentleman, who had been employed by his king in planting a colony upon the Straits of Magellan, for when I asked him, being then my prisoner, some questions about an island in those straits, which might, methought, have done either benefit or displeasure to his enterprise, he told me merrily that it was called the 'painter's wife's island'; saying, while the fellow drew that map, his wife, sitting by, desired him to put in one country for her, that she in imagination might have one island of her own."

The first map of Virginia bears the name of John With, and was made in manuscript about the year 1585. Why Hariot did not insert it in his description of Virginia, published first in 1588, as he and John With must have been together and cognizant of each other's doings, is a question that can be left only to the imagination.

John With, or White the painter, and John White, the governor of Virginia appointed by Raleigh, have been identified by modern writers as one and the same person. Why this should have been done I do not know, for, as far I can find out after considerable study of the subject, I do not think the conclusion is warranted by the information we have relating to their lives.

That there is little known of the painter is not surprising, as painters were looked upon in those days as of small consequence, but I am surprised at the little information that has reached us about the governor.

I will now investigate very fully, as far as my reading has gone, the identity of these two men, quoting all I can find for and against the above conclusion, so that the reader may judge for himself in the premises.

In a volume written in the stilted but quaint style of the day, entitled "Athenae Oxoniensis, by Anthony à Wood, London, 1691-2," is found almost all we know of one Master Thomas Hariot, who, according to the author's statement, "tumbled out of his mother's womb into the lap of the Oxonian muse, in 1560." At an early age Hariot became the much admired protégé of Sir Walter Raleigh, on account of his great intellect, and, like his gallant patron, was possessed of a spirit of adventure, which carried him away to explore unknown countries.

Wingandacoa, so called by the natives, and Virginia, as named by Raleigh, in honor of his fickle Queen, Elizabeth, was at that time little known, and from hearsay offered an opening to the adventurous of vast proportions. The spirit of discovery was ignited by Hariot, who had remained in the colony governed by Robert Lane, in 1585-1586. Soon after his return to England he wrote a report, for the edification of Raleigh, which to this day is valued, not only from being the forerunner of many statistical works and from its intrinsic value, but from its now extreme rarity; it is a small volume of twenty-three leaves, without map or plates, and was published in London, 1588. At the end is a statement to the effect "Of the Captaynes and Masters of the voyages made since for transportation; of the Gouernour and assistants of those alredie transported, as of many persons, accidēts, and things els, I have ready in a discourse by it self in maner of a Chronicle according to the course of times, and when time shall be thought conueient shall be also published." Whether this "Chronicle" has ever been published, and, if not, what has become of the manuscript, is a question of great literary interest.

The second edition of Hariot was published in Hakluyt's "The Principall Navigations," in 1589, with the various other reports of Raleigh's expeditions sent to Virginia, also without plates or map.

The third edition, published as the first part of the celebrated De Bry collection in 1590, is the one of chief interest to America. Four versions were published during the same year, in English, Latin, French, German, all containing the plates and map.

The original English text is among the very rare Americana, and few copies are known of in this country; I derive my infor-

mation from the excellent reprint by Sabin, and also from that by the Holbein Society.

It is only in the English text that the artist is called White; in the others he is named With, and the same spelling of the name occurs on all the maps which are in Latin, including the map to the English text. All the information we have concerning the artist, whom I shall call With, is found in this book.

In an examination of many volumes of more recent date I find only one notice of his life, which is evidently taken from De Bry, and is entered under the name *With* in Nagler's Künstler-lexicon, 1851.

I shall mention all that is found in De Bry relating to the artist, most of it being on the title-page to the plates; I quote from Hariot's text:

"The trve pictvres and fashions of the people in that part of America now called Virginia. (etc.) Translated out of Latin into English by Richard Hacklvit. Diligentlye collected and draoune by Iohn White, who was sent thiter speciallye and for the same purpose by the said Sir Walter Ralegh, the year abouesaid 1585, and also the year 1588, now cutt in copper and first published by Theodore De Bry att his wone chardges."

Further on in the title to the five pictures of the Pictes, a reference is made to "the painter of whom I have had the first of the inhabitants of Virginia, give my allso thees 5 figures."

In the preface "To the gentle reader," we find also the following:

"Consideringe, Therefore, that yt was a thing worthie of admiration, I was very willinge to offer vnto you the trve pictvres of those people wich by the helfe of Maister Richard Hakluyt (etc) who first encouraged me to publish the worke, I creaued out of the verye original of Maister Ihon White an Englisch paynter, who was sent into the countrye by the queenes Maiestye, onlye to draw the description of the place by lynelye to describe the shapes of the inhabitants their apparell, manners of liuinge, and fashions, att the speciall charges of the worthye knight, Sir Walter Ralegh, from te yeers 1584, to the ende of the years 1588."

That the text was written to explain the pictures admits of no doubt from information on plates 6, 10 and 18, and it is

reasonable to suppose from the following text, taken from some of the other plates, that the author was the same as the artist:

"Plate 2. The sea coasts of Virginia arre full of Ilāds whereby the entrance into the mayne lād is hard to finde. For although they bee separated with diuers and sundrie large Diuision, which seeme to yield conuenient entrance, yet to our great perill we proued that they were shallowe, and full of dangerous flatts, and could neuer perce opp. into the mayne lād, vntill we made trialls in many places with or small pinness. At lengthe wee found an entrance uppon our men diligent serche thereof. (etc.) Such was our arriuall into the parte of the world, which we called Virginia, the stature of bodee of which people, theyr attire, and maneer of lyvinge, their feasts, and banketts, I will particulerlye declare unto you."

"Plate 17. And singinge after their maneer, they make merrie: as myselfe obserued, and noted downe at my beinge amonge them."

"Plate 21. Thes poore soules haue none other knowledge of god although I thinke them verye desirous to know the truthe. For when as we kneeled downe on our knees to make our prayers vnto god, they went abowt to imitate vs, and when they saw we moued our lipps, they also dyd the like."

"Plate 23. And to confesse a truthe I cannot remember, that euer I saw a better or quietter people than they. The marks which I obserued amonge them, are heere put downe in order followinge."

To warn literary pirates from making use of his plates, De Bry, in the preface "To the gentle Reader," very cunningly announced that "dyuers secret marks lye hidden in my pictures, which wil breede Confusion vnless they bee well obserued." The information on the title that it was "Translated out of Latin into English by Richard Hacklvit," does not take away from the proof that With was also the author of the text, as Latin was a language in those days well known to scholars and artists.

Now that I have given all there is in De Bry relating to the painter John With, let us look into Hakluyt's "The Principall Navigations," editions of 1589 and 1598, and note all passages in which the name John White occurs. All the original reports of the various expeditions sent out by Raleigh to Virginia, from

the first in 1584 to the fifth in 1588, excepting the Hariot, were originally published in the above-mentioned volume. The account of the first voyage, in 1584, gives a list on page 733 (edition 1589) of ten names and no White is found among them. The second voyage, in 1585, on page 733, also mentions eight names of "The principall gentlemen of our companie," and still no John White.

The first mention of a John White is made on page 735, of the same expedition: "The 11. day the Generall (Sir Richard Greenvill) accompanied in his tile boat with Master John Arundell, Master Stukelye and diuers other Gentlemen, Master Lane, Master Candish, Master Harriot, and 20 others in the neue pinnesse, Captain Amadas, Captaine Clarke, with tenne others in a ship boate, Francis Brooke, and John White in another ship boate passed ouer the water from Ococon to the mayne land, victualled for eight days in which voyage we first discouered the townes of Pomicke, Aquascogoc and Secota, and also the great lake called the Sauages Paquype, with diuers other places, and so returned with that discouery to our fleete."

Let me say here that all the places "first discovered" are found on With's map.

Who is the John White mentioned above without either the title Master or Captain, in an account where such titles are lavishly given? Is this the poor painter whose trade was of so little account?

In a letter from Governor Lane, from Port Ferdinando, Va., published for the first time in "Archæologia Americana, v. 4," dated 8th September, 1585, the above Francis Brooke is mentioned as "our Treasurer," with no mention of John White.

In the list of one hundred and seven names of those "As well Gentlemen as others" (pages 736-737 of Hakluyt) who remained with Lane in Virginia "one whole yeere" (1585-1586), Master Hariot is mentioned and a John Wright and John Twyt, these last two evidently, from place on the list, members of crew. This looks as if the only John White referred to had returned to England or had been lost, unless one of the two names above mentioned answers to the description.

On page 770 (Hakluyt) in "The names of the men, women and children, which safely arrived in Virginia, and remained to

inhabite there. 1587," John White heads the very long list. As all these were set upon by the Indians and lost sight of after much search by various expeditions sent out for their rescue, this John White is only interesting on account of his name.

The fourth and fifth voyages, 1587-1588, were under the command of John White, whom Raleigh appointed Governor of Virginia, and who wrote reports of the voyages, containing nothing, however, which gives us an insight into his past history.

That he was five times in Virginia is stated by himself in a letter dated "from my house at Newtowne in Kylmore (Ireland), the 4 of February, 1593," to "My very friend Master Richard Hakluyt," in which, on page 287, edition 1598, he speaks of "his fift and last voiage to Virginia, in the year 1590."

Williamson, in his History of North Carolina, note to p. 50, vol. 1, gives this interesting piece of information: "Governor White, on his return to England, touched at a port in Ireland, where he is believed to have left the potatoe that thrives so well in high latitudes, though it cannot resist intense cold."

Let us now see what writers of more modern date say concerning John White.

In Stith's History of Virginia, published in 1747, mention is made of John With, "a skillful and ingenious painter," and further on, "Mr. John White, who was governor of the colony."

Camus, in his "Mémoire sur la collection des grands et petits voyages" (De Bry), Paris, 1802, p. 42, has the following information:

"La carte de la Virginie n'a pas été rédigée d'après des observations astronomiques; elle a été dessinée par Jean With, peintre anglais, que la reine Elizabeth avoit envoyé en Virginie pour en lever la topographie." And again in note on page 43, "La qualité de peintre que de Bry donne à Jean With me fait douter que cet individu soit le même qui fut envoyé dans la Virginie en 1588."

Bancroft, in his "History of the United States," Vol. I, has this criticism on several celebrities in the expedition of 1585: "It sailed from Plymouth, accompanied by several men of merit, whom the world remembers:—by Cavendish, who soon after circumnavigated the globe; Hariot, the inventor of the system of notation in modern algebra, the historian of the expedition; and

With, an ingenious painter, whose sketches of the natives, their habits and modes of life, were taken with beauty and exactness, and were the means of encouraging an interest in Virginia by diffusing a knowledge of its productions."

A few pages further on Bancroft refers to the Governor, John White, showing thereby he recognized a difference.

The following account of With, from Edward E. Hale, in Archæologia Americana, v. 4, 1860, pp. 20-23, contains much that is of interest:

"I had heard the suspicions which hasty criticism has thrown on the genuineness of the drawings in de Bry's great volume. I was glad to dispel these suspicions by finding in the British Museum the originals of some of these drawings, and many more of the same series. In a report which I presented to the Antiquarian Society in April, 1860, I gave some account of them.

"The collection consists of one hundred and twelve drawings, in water-color, very carefully preserved. They came to the Museum with the collection of Sir Hans Sloane, and the volume has this entry, which is believed to be in his handwriting:

"'The original drawings of the habits, towns, customs, of the West Indians, and of the plants, birds, fishes, &c., found in Groenland, Virginia, Guiana, &c., by Mr. John White, who was a painter, and accompanied Sir Walter Raleigh in his voyage. See the preface to the first part of 'America' of Theodore de Bry, or the 'Description of Virginia,' where some of these draughts are curiously wrought by that graver.'

"If there were no title, the identity of many of the paintings with the prints in De Bry would show that they were by the same hand. That those are copied from these is shown by the fact that the prints sometimes reversed the paintings, giving the right hand for the left. This collection is much larger than that in De Bry, numbering nearly one hundred American pictures; from which a part only were selected to be copied for engraving. In De Bry there are only twenty-three. For several of the prints in De Bry there are no originals here, and I am disposed to think that the artist copied from these originals those which were sent to Germany; that he sent also some of the originals; and that the copies from which the engravers worked are not in this collection.

"This very curious collection exhibits, even more than the spirited engravings in De Bry, the ability of the artist to whom Sir Walter Raleigh intrusted the representation to the eye of his new colony. They are very well drawn; colored with skill; and, even in the present state of art, would be considered anywhere valuable and creditable representations of the plants, birds, beasts, and men of a new country. The collection includes other studies of the artist; a prince of Genoa in his court-dress, and many Italian plants, being found within the same covers as the chiefs, squaws and pappooses, and woodpeckers, herrings and hepaticas of Roanoke. The distinguished naturalist, Dr. Francis Boott, was so kind as to examine the collection at my request, and confirms my own impression, that the plants and birds must have been studied on the spot by the artist, as no specimens of them then existed elsewhere in the world.

"The volume in which these drawings are found is a scrap book, made apparently by one hand. Among the paintings is a print of Cromwell, and an India-ink painting; not, I think, by White's hand.

"An indorsement in another hand than Sloane's, dated 1673, says: 'There is in this book a hundred and 12 leaves, with flowers and picters and Fish, and of Fowls, besides wast paper.'

"The representations of animals and plants give peculiar value to the series; for the intimation has been thrown out that the artist of De Bry's plates was never in America. These representations of American birds, fishes, insects and plants could not have been made in Europe.

"The various pictures in the volume are: ten of Virginia Indians, of which one is the front figure of Plate IIII. in De Bry; one is the front figure of III. in De Bry, where it is reversed by engraving; one is VIII. of De Bry, the woman a little differing from the print; one is XIX. of De Bry, four times the size of the print, and without the trees."

In Kohl's "A descriptive catalogue of those maps, charts, and surveys, relating to America, which are mentioned in volume three of Hakluyt's great work," pages 41-47, is a long argument on the identity of the painter and governor.

That he is not quite correct in his reference to Hakluyt and De Bry is evident by a comparison from these writers with my

quotations, but the reader can judge for himself from the following quotation from his catalogue mentioned above:

"Also during the time of the so-called second colony of Virginia, under the charge of John White, some explorations were made. John White sailed from England on the 26th of April, 1587, and returned to England in November, 1587, leaving his 'second Colony' in the country, with the intention to bring them supplies.

"John White made afterwards another voyage to Virginia, to look after his forsaken and unhappy colonists, which he left there in 1587, without being able to return so soon. He set out for this voyage from England on the 20th of March, and returned to England on the 24th of October, 1590. On this voyage he made no new explorations at all, and it is therefore very probable that the map of Virginia which is ascribed to him, and of which we have still a copy, was prepared on the voyage of 1587.

"Where the original draughts of this map of White remained we cannot tell. But the first printed copy of it has been given to the world by Theodore de Bry, in the work 'Admiranda Narratio, finde tamen digna de commodis et incolarum ritibus Virginiae, etc., Francoforti ad Moenum. Anno MDXC'—(Wonderful relation, nevertheless very true, of the commodities and of the customs of the inhabitants of Virginia.—Frankfort-on-Main, in the year 1590.)

"The well known map in this book has the title 'Americae pars nunc Virginia dicta, primum ab Anglis inventa sumtibus Dni. Walteri Raleigh, Anno Dni. MDLXXXV,' etc.—(A part of America now called Virginia, for the first time found by the English, on the expenses of Sir Walter Raleigh, in the year of our Lord 1585).

"This map of the country which we now call North Carolina is, by De Bry, put at the head of a collection of images, pictures and sketches, on which he makes the following remark: 'Omnia deligenter observata, et ad vivum expressa Joanne With ejus gratia in illam provincian annis 1585 et 1588 misso. Deinde in aes incisa et primum in lucem evulgata a Theodoro de Bry.' (All this is accurately observed and after nature expressed by John With, who for the purpose was sent to that province in the years 1585 and 1588. Afterwards it was engraved and, for the first time, published by Theodore de Bry.)

"On the map itself we find again the inscription: 'Auctore Joanne With. Sculptore Joanne de Bry.' (The author of this map was John With, the engraver, John De Bry.)

"De Bry gives us no further information about the history and the author of the map except that he procured (bought?) it in England. The question is, who this 'John With' was who is named as the author of this interesting document—the oldest map of Carolina? I think he cannot be any other man but the Captain John White. Camus thinks that he was a 'painter' sent over to Virginia with one of the captains, and says that he is called somewhere 'pictor.' He does not, however, give his authority for this. In De Bry there is nothing about it. That De Bry makes him to be as well the author of the Indian portraits and views is no proof of his being a painter. Those fanciful portraits and views were probably all invented by De Bry himself, and were never made after nature, neither by a *painter* nor by *Captain* John White or With.

"To make our pretensions more plausible we must at first state that there is some confusion in De Bry as well in writing the name of his map-maker as in the dates of his voyage.

"He writes the name of the map-maker once 'Whit' and once 'With.' Captain John White writes his name always 'White.' When De Bry was, as it is shown, uncertain about the spelling of this name, then we may assume that none of his two spellings was right, and that the name ought to be 'White.'

"His dates are also partly wrong. He says that 'John With' was sent out to Virginia in 1585 and 1588. In the expedition of 1585, under Sir Richard Greenville, no 'painter John With' is mentioned; but our Captain 'John White' is mentioned. That in the year 1588 a 'painter John With' should go out to Virginia is very improbable, because we do not know of any Virginian expedition of that year in which the poor suffering 'second colony' was left quite alone there. De Bry thought probably of 'Captain John White's' expedition of the year 1587. We find also on the list of the settlers in the second colony no 'John With' mentioned, only '*John White,' the Captain and Governor of the Colony.*

"From all this I conclude that 'John With,' which De Bry puts down as the author of the map, is nobody else than the

often-mentioned Captain and Governor John White. If he really made and drew the map may be doubted. De Bry procured probably the map from White and made him to be the author. But it is possible that Captain John White compiled the map, or directed it to be compiled, as well from his own observations as also from the notes, reports, and draughts of his predecessors—principally of Ralph Lane, who, as I said, after the loss of his cards, may have made another sketch.

"The picture which we find on the map resembles very much the description which Ralph Lane gave of his discoveries. We find on it Chesapeake Bay ('Shesepiooc Sinus'), and also the river 'Moratuc' (our Roanoke river). John White, who never was in this bay and river, could only lay them on his map after *Lane.*

"Because in Hakluyt this map is not mentioned at all we must abstain from a further criticism of it, and may only add the observation, that this map remained for a long time a model and type for all geographers who made maps of this part of America (North Carolina), because it lasted more than sixty years after the unsuccessful colonization of Roanoke, until the exploration and settlement of those regions commenced anew. We therefore see this picture of John White reproduced many times in the atlases of Mercator and Hondius, and in the works of Laët. Nay, even still the first cartographers of the province of Carolina seemed to have used the picture of 'Ould Virginia.'"

Henry Stevens, in his catalogue of books relating to America, entitled "Bibliotheca Historica," Boston, 1870, page 233, has the most extensive account of the identity of the artist and governor, from which I cite the following:

"But in reprinting Hariot's report, and illustrating it with White's pictures, did not De Bry exaggerate and embellish? The answer is, no, for the following reasons: In the year 1865 John White's original paintings in water colors, made for Sir Walter Raleigh in 1585, fell by purchase into the hands of the writer, and in March, 1866, fell into the right place in the Grenville Library in the British Museum, at the moderate cost to the trustees of £236 5s. od. They are now a prominent part of the world-renowned 'Grenville De Bry.' A glance at the drawings will show that they are the works of an artist, and portraits, whether

of men, women, animals, fish, fowls, fruits or plants. They are highly finished. De Bry's copies are very close, but not embellished. The following extracts from the writer's report on the collection, dated 22d of March, 1866, when offering it to the Trustees of the British Museum, are given with the hope of removing some of the aspersions that have been of late cast upon the famous collection, and encouraging collectors to repose confidence in the honesty of the great Frankfort family of engravers. The drawings are beautifully bound in two volumes in red morocco.

"'To A. Panizzi, Esq., etc., etc., British Museum. . . . The two volumes, with some aids from the Grenville Library, will speak for themselves, but the following notes may facilitate your researches. They are chiefly drawn out of Hakluyt, Purchas, De Bry, Hariot, Captain John Smith, and others.'

"'The larger volume contains seventy-six original drawings in colors done for Sir Walter Raleigh by John White, the English painter, who was sent by Queen Elizabeth, in 1585, to Virginia, as principal draughtsman in Raleigh's famous second expedition for exploring the country and planting his 'First Colonie.' This expedition of seven ships was under the command of Sir Richard Grenville, the ancestor, I believe, of the founder of the Grenville Library. Thomas Candish, or Cavendish, was also of the fleet, and Master Ralph Lane was the Governor of the Colonie. This 'First Colonie,' consisting of 109 men, remained in Virginia one whole year and then returned to England in July, 1586, in Sir Francis Drake's fleet, returning victorious from the West Indies, because the long expected supplies and reinforcements from England had not arrived. Fourteen days after their departure, Sir Richard Grenville arrived with new stores and new planters, to find the Old Colonie deserted.'

"'To Thomas Hariot and John White, two of these 109, we owe nearly all we know of that grand and most unfortunate expedition, and it is not too much to say, I think, that to them alone we may fairly ascribe nearly all the accurate knowledge we have of the Indians and the natural history of that country for a full century later.'

"'Nothing is recorded of John White in modern dictionaries of art or biography, yet from De Bry and Hakluyt we learn that he was both an eminent artist and an influential man in his day. He made no less than four voyages to Virginia; was an 'adventurer' in the 'First Colonie'; the Governor of the 'Second Colonie' in 1587; and the grandfather of Virginia Dare, the first English child born in North America; the friend and agent of Raleigh, and the associate of Hariot. Many of Governor White's letters and journals are preserved by his friend Hakluyt. His last voyage to Virginia was in 1590, as chief of Raleigh's 'Fifth Expedition,' to aid and reinforce the Colonie of 1587. He returned unsuccessful the same year and retired to Ireland, whence he dates a letter, long and important, to his friend Hakluyt, 'from my house at Newtowne, in Kylmore, the 4th of February, 1593.'

"'Theodore De Bry, in his second visit to London in 1588, was introduced to White by Hakluyt, who suggested to that eminent engraver, then projecting his Grand Collection of Voyages, to reprint Hariot's 'Report of Virginia,' then just issued, and illustrated with the pictures of John White. Hakluyt also persuaded De Bry to delay his *Florida* and make the Virginia his first part. White's pictures were copied, and the artist, returning to Frankfort, with incredible enterprise completed the engravings in a masterly manner and issued the work in 1590, in folio, four editions, in four languages—English, French, German, and Latin—a monument of beauty and art to himself, to Hariot, and to John White. Not more than five or six copies of the English edition are now known in England, and for the last century had never sold complete for less than 100 guineas, and would now bring probably 200 guineas. The copy in the Grenville Library is the finest I have seen.'

"'These drawings now offered to the trustees are no doubt the identical paintings that were copied by De Bry and published in 1590. Beautiful as De Bry's work is, it seems tame in the presence of these original drawings. De Bry copies only about one-third of the drawings. The rest have never been engraved, though some of them were used in the *Florida*, and in the third and sixth parts. There is a volume of White's (perhaps partly Le Moine's) drawings in the Sloan collection

(No. 5270), but they are not duplicates of these. A few of them are similar designs. The price of this volume is 200 guineas (£210). The price of the smaller volume, if the other be taken, is 25 guineas (£26 5s. od.; together, £236 5s. od.). The story of the smaller volume is very curious. At the fire at Sotheby's in June, 1865, the drawings were saturated with water, and remained so for three weeks under heavy pressure, which produced these remarkable 'off-tracts.' I have had them carefully preserved, reversed in the binding and sized, at no little cost of time and money.

I am, dear sir, yours faithfully,

HENRY STEVENS.'"

Winsor, in his "Narrative and Critical History," volume 3, page 124, in which there is a facsimile of the map, simply says that "Stevens, Bibliotheca Historica, 1870, page 222," identified the John White the artist with Governor John White. Dr. Edward Eggleston, in an article of unusual interest published in the Century for November, 1882, on page 68, says: "John White, the artist of the expedition, who became Governor of the second colony, made some admirable drawings of the Indians." On pages 66-67 is a "Map of southern part of Atlantic coasts of North America, showing the strait leading from Port Royal to the south sea (drawn in 1685 by John White, artist to Raleigh colony, now first published by permission of the British Museum)."

This facsimile, the only one I have seen, has a double interest on account of the subject and artist.

After reading the various opinions of the eminent writers quoted in the above pages, it can readily be seen that Kohl and Stevens are the authorities for the identity of John With the artist with John White the Governor. All other writers have blindly followed in their lead.

By comparing Kohl's statements with the original quotations from Hakluyt and De Bry, as given above, one cannot help seeing the incorrectness of his views, as well as his inaccuracies, especially since the recent discovery of the original drawings of John With or White in the British Museum.

Stevens, in his article as also quoted, states, "A glance at the

drawings will show they are the works of an artist"; also that "nothing is recorded of John White in modern dictionaries of art and biography."

Notwithstanding this, he takes it for granted that the artist and the Governor are the same, and his views are accepted by Justin Winsor.

To conclude, all we know of John With or White is from De Bry, who repeatedly calls him a "painter" and one "sent thiter speciallye" for the purpose of making drawings of the natives and other objects of interest.

The tendency of the day is to consider most old writers as given to statements not warranted by fact, but we should at least give them the benefit of the doubt until the contrary is proved.

The rapidity with which men, especially navigators, achieved fame in the days of Raleigh can only be compared with the promotion of French soldiers in the days of the first Napoleon. Yet it is hardly probable, though of course possible, that a person sent out especially for the purpose of his craft should, in a few years, attain the position of commander in two expeditions and become Governor of Virginia. So with all due deference to the scholarly views of Kohl, Stevens, Winsor, Eggleston and others, I find myself unable to agree with them as to the identity of John With the artist and John White the Governor, until at least further information on the subect is forthcoming.

1597.

From John With's map of 1585 to Capt. John Smith's map of 1608, I find only one map which has the name "Virginia" as part of its title, viz. "Norvmbega et Virginia, 1597." This is found following page 184 in Wytfliet's "Descriptionis Ptolemaicæ augmentum, fol. *Lovanii*, 1597."

On pp. 182-183 is a description of Virginia, ending as follows: "Sed de moribus & naturâ indigenarum, deque alijs Virginiæ commoditatibus aut mirabilibus plura ex descriptione Iohannis Wyts, & relatione Thomæ Harioti præsati Rallegi domestici, per Theodorum Brium singulari libro descripta, & æneis formis incisa circumferuntur."

The map differs only in delineation from With's map, has no additional information in the part relating to Virginia, but extends farther north, taking in the coast as far as Cape Breton.

CAPTAIN JOHN SMITH'S MAP OF VIRGINIA, 1608.

If we knew nothing of Captain John Smith but what is conveyed to us by his map of Virginia, it would alone entitle him to rank pre-eminently high among great explorers and cartographers.

Journeying along unknown streams in a country where at every step lurked danger from enmity of the savage inhabitants and discord among his followers, Smith made a map which is an authority to the present day, and when compared with other maps of his day, impresses us with the genius of the man who combined in himself so many characteristics of greatness.

In the boundary dispute between Virginia and Maryland in 1873, Smith's map was used as an authority, and prior to that it was the foundation upon which all maps of Virginia were constructed. Its topographical correctness is remarkable, and the knowledge of Indian names and localities has been a rich harvest from which historians have abundantly reaped.

Major Jed. Hotchkiss, the greatest authority on the geography of Virginia, writes the following letter, dated October 5, 1883, published in Arber's reprint of Capt. John Smith's works:

"I am sorry to say that about the only information we have concerning the location of Indian tribes at the time of the settlement of Virginia is to be found on Smith's map, a marvel of results in representation of outline compared with the time occupied in procuring information. The same region is shown on the small map I send you from the actual survey of a century (1774-1874), yet Smith had all the important features of our wonderfully developed coast well shown."

In eloquent words our great historian, George Bancroft, in his History of the United States, pays tribute to the ability of Smith:

"Disgusted at the follies which he had vainly opposed, Smith undertook the perilous and honorable office of exploring the vast bay of the Chesapeake and the numerous rivers which are

its tributaries. Two voyages, made in an open boat, with a few companions, over whom his superior courage, rather than his station as a magistrate, gave him authority, occupied him about three months of the summer, and embraced a navigation of nearly three thousand miles. The slenderness of his means has been contrasted with the dignity and utility of his discoveries, and his name has been placed in the highest rank with the distinguished men who have enlarged the bounds of geographical knowledge and opened the way, by their investigation, for colonies and commerce."

"He surveyed the bay of the Chesapeake to the Susquehannah, and left only the borders of that remote river to remain for some years longer the fabled dwelling-place of a giant progeny. The Patapsco was discovered and explored, and Smith probably entered the harbor of Baltimore. The majestic Potomac, which at its mouth is seven miles broad, especially invited curiosity; and passing beyond the heights of Vernon and the city of Washington, he ascended to the falls above Georgetown. Nor did he merely explore the rivers and inlets. He penetrated the territories, established friendly relations with the native tribes, and laid the foundation for future beneficial intercourse. The map which he prepared and sent to the company in London is still extant, and delineates correctly the great outlines of nature. The expedition was worthy the romantic age of American history."

Smith, with his great geographical knowledge derived from travels in Europe, Asia and Africa, must have been inwardly amused at the "Instructions given by way of advice, for the intended voyage to Virginia," by the London Virginia Company. I say inwardly amused, for the spirit of adventure and research which characterized his life induced him silently to obey the company's dictates, which were to this effect: "You must observe, if you can, whether the river on which you plant doth spring out of mountains or out of lakes. If it be out of any lake, the passage to the other sea will be more easy, and is like enough, that out of the same lake you shall find some spring which runs the contrary way towards the East India Sea."

Smith, soon after landing in Virginia, started to explore, not, however, from any idea of finding a short cut to the "East India Sea," but to form a correct impression of how the land lay for the benefit of old England and her colony.

In June, 1608, Captain Francis Nelson, commanding the Phoenix, left Virginia to return to England, and arrived there early in July of the same year. This voyage is memorable for the precious cargo on board the ship of Capt. Smith's first account of the doings in Virginia.

The Relation was entered at Stationer's Hall, London, August 13, 1608, under the following title, which differs from the printed one, as it mentions Nelson's name:

"A true relation of such occurrences and accidents of note as have happened in Virginia synce the first planting of that Colonye which is nowe resident in the south parte of Virginia till master Nelson's comminge away from them, etc."

The title of the printed book reads in this way:

"A Trve relation of such occurrences and accidents of noate as hath hapned in Virginia since the first planting of that Collony, which is now resident in the South part thereof till the last returne from thence. 40 pp. 4°. London, 1608."

The printed title conveys no idea to the ordinary reader as to when this Relation was sent from Virginia, but the title as entered at Stationer's Hall fixes the time without doubt.

This relation narrates the history of the colony from the arrival at Chesapeake Bay, April 21, 1607, to June 2, 1608.

We find no information in it regarding the map, and therefore infer that it was made after the sailing of Nelson in June, 1608, during Smith's three months' exploration of the Chesapeake.

Smith wrote a letter "To the Treasurer and Councell of Virginia," and in it he says: "I have sent you this mappe of the Bay and Rivers, with an annexed Relation of the Countries and Nations that inhabit them, as you may see at large." This letter was not published until sixteen years after, in his "The Generall Historie of Virginia, New England, etc. 3d book, 1624."

In this letter Smith mentions the appointment of Winne and Waldo to the Council, the coronation of Powhatan, the arrival of Newport, and other matters occurring at that time; so it must have been written on his return to Jamestown after his exploration of the Chesapeake, September 7, 1608, and a short while after being confirmed as President by the Council, September 10, 1608.

The letter was carried to England by Captain Newport, who sailed from Virginia in November, 1608, reaching there in January, 1609.

The map and relation mentioned in the letter requires some discussion.

In 1612 was printed at Oxford—a most unusual event—a pamphlet, without a map, with this title: "A map of Virginia. With a Description of the Coventrey." The map was published previous to the text above-mentioned, which describes the map. This is proved from the following extracts from "Purchas his Pilgrimage. fol. London, 1613," page 634, and entered at Stationer's Hall, August 7, 1612.*

It is well to notice these dates, so that the application of the following quotations from the above volume can be appreciated:

"Concerning the latter, Captain Iohn Smith, partly by word of mouth, partly by his Mappe thereof in print, and more fully by a manuscript which hee courtiously communicated to mee, hath acquainted mee with that whereof himselfe with great perill and paine, had been the discouerer, being in his discoueries taken prisoner, and escaping their furie, yea receiving much honour and admiration among them, by reason of his discourses to them of the motion of the Sunne, of the parts of the World, of the Sea, etc. which was occasioned by a Dyall then found about him. They carried him prisoner to Powhatan, and there beganne the English acquaintance with the Sauage Emperour."

And again from the same work on page 635:

"To speake of Powtuxent, Bolus and other Rivers on the East side of the Bay: likewise of diuers places which received name by some accident, as Fetherstones Bay, so called of the death of one [of] ours there happening, and the like; or to mention the numbers which euery people can make, would exceede our scope, and the Readers patience. Captaine Smiths Mappe may somewhat satisfie the desirous, and his booke when it shall bee printed, further. This the Captaine saith, that hee hath beene in many places of Asia and Europe, in some of Africa and

* The first edition of Purchas was called Purchas his Pilgrimage. It is an entirely different work from his larger collection of Pilgrimes. The distinction between the two works is explained by the author himself in the dedication prefixed to the 4th edition of the "Pilgrimage."

America, but of all, holds Virginia by the naturall endowments, the fittest place for an earthly Paradise."

That the manuscript here mentioned is the text afterwards printed at Oxford in 1612 admits of no doubt from the extracts made from it by Purchas for "his Pilgrimage," published in 1613. He seems peculiarly pleased in quoting the refrain "Love you not mee" with which the Indian maidens greeted John Smith, as related in "A map of Virginia, 1612."

The text of this book, from evidence at the end, was written after Smith had returned to England in December, 1609. We should infer, however, from his letter before quoted to "The Treasurer and Councill," that the text called "A map of Virginia" was sent home by Newport in November, 1608. If this be the case, Smith must have recovered his manuscript on his return to England and shown it to Purchas.

We have now followed Smith's map from its departure from Virginia in 1608 to Purchas seeing it, who, as before stated, mentions the map in print and the text in manuscript before August 7, 1612, when "his Pilgrimage" was entered at Stationer's Hall.

Having, therefore, formed a pretty correct idea of the time when the original map was published, I shall now quote the differences in the four impressions I have examined and compared. Smith evidently revised his first map, as the one published in his "Generall Historie" has several additions, which are "Sparkes Poynt," "Washeborne," "Boolers Bush," "Fetherstones Baye," "Blandes C," "Downesdale," and "Sparkes Content" is also changed to "Sparkes vaylley."

Fetherstones Baye on "Toppahonock flu" is so called after Master Richard Fetherstone, who died on the second expedition, August, 1608. As this bay is not mentioned on the original map, the inference would seem to be that Smith made it before this event. The original map before these changes is found with the perfect copies of the text which it describes.

Another impression, which was evidently intended for "Purchas his Pilgrimes," has the pagination numbers 1692, 1693, at the top, with the above-mentioned places omitted as in the original, also without "41 Smith" ("The Generall Historie") in the lower right-hand corner. This I assume to be the second

impression which was struck for "Purchas his Pilgrimes," vol. 4, edition of 1625.

The two other impressions are the revised ones for Smith's "The Generall Historie of Virginia, New England & The Summers Isles, 1624," and inserted from "41 Smith" (on the map) at that page of the text. The Purchas pagination numbers of the third and fourth impressions also differ, as they are 1690, 1691, and contain all places omitted from the original map. One of these two impressions has also no engraver mentioned, and the date 1606 directly under "Discouered and Described," and not under Smith as in the others.

It is very difficult to find in the various editions of "The Generall Historie" the correct map belonging to each edition, and even in Purchas these maps are often found inserted. All the maps, however, were copied from the Purchas impression, as seen by the pagination numbers of that book, 1690 and 1691, 1692 and 1693, at the top.

In explanation of the small black crosses on the map, Smith says in his text:

"In which mappe observe this, that as far as you see the little Crosses on rivers, mountains, or other places, have been discouered the rest was had by information of the Sauages, and are set downe according to their instructions."

The other map—"Ould Virginia"—published in "The Generall Historie," is here referred to only on account of its title, as it contains nothing of what is now Virginia.

Chart of Virginia, 1608.

A facsimile in Alex. Brown's "The Genesis of the United States," vol. 1, p. 184. The author gives an extensive notice to this map, from which I quote the following: "This chart must have been sent to England by Capt. Francis Nelson, who left Virginia, June 2, 1608. It is not drawn on an exact scale; it seems to have been drawn on the basis of about five miles, or say one and a half leagues to an inch. It illustrates Captain John Smith's True Relations, and was sent from Virginia with it. The 'Relation' was published in August, 1608; but I have never seen an engraving of this chart."

Page 461, same: The author of "New Albion" (1648), in describing Delaware Bay, refers to Captain Smith's *book* of Virginia, and a Captain Powel's map.

THE DRAUGHT BY ROBERT TINDALL OF VIRGINIA, ANNO 1608.

A chart of James and York rivers. The facsimile is in Alex. Brown's "The Genesis of the United States," vol. 1, page 151, who says: "This 'Draught of Virginia' is the earliest drawn by an Englishman now known to be in existence. It has never been engraved before."

Tyndall made a plan of James river for the Prince of Wales in 1607, which is now probably lost. Brown, vol. 1, page 457, under "Map of America."

Alexander Brown, in his "The Genesis of the United States," vol. 2, pp. 596-597, gives a facsimile of a map sent by John Smith in 1618 to Lord Bacon "to show the difference betwixt Virginia and New England." Brown gives this as an illustration of Smith's ignorance of map-making, and says: "I have found no real evidence that Smith could draw a map." A reduced facsimile of Smith's Virginia map is also given.

1619.

Title from Muller's Catalogue. Amsterdam, 1877, p. 120: "Atlas sive Cosmographicæ meditationes de fabrica mundi et fabricati figura. Denuo auctus. Edit. 4a. *Amsterodami. Jud. Hondius*, 1619. *With portr of Mercator and* Hondius and 156 coloured maps. Text in French." "This edition of the celebrated Atlas of Mercator is not the *fourth* (which appeared 1613), as the title says, but the *seventh.* It contains 105 maps by *Mercator* and 51 by *Hondius* a. o., among which 9 maps of America: Mappemundi; General map with special ones of Cuba, Haiti and the Gulf of Mexico; General map with ethnographical figures, f. i.: *Navicula Floridanorum, Modus conficiendi et bibendi potum apud Amer.*, etc.; Arctic regions with Greenland, Hispania Nova; Virginia and Florida, on which the naked figure of the King and Queen of Florida (with the rather superfluous remark: '*Plebi non multum ab his differunt*') *Civitatum Floridae et Virginiae formae*, and some historical annotations."

1624.

"Nova Anglia, Novvm Belgivm et Virginia," is the title of the map in Jan de Laet's "Nieuwe wereldt ofte beschrijvinghe van West Indien, fol. *Tot Leyden,* 1625." The part relating to Virginia is taken from Capt. John Smith's map.

1628.

In the thirteenth part of De Bry, German text, *Frankfurt,* 1628, is a German ed. of Capt. John Smith's Map of Virginia, from the first impressions before the additions.

1630.

The following three titles are taken from Dufossé's Americana, 6e série, No. 2: "Virginiæ partis Australis et Floridæ partis orientalis, interjacentium que regionum nova descriptio (Amsterdam, Guill. Blaeu, 1630)." "Nova Virginiæ tabula. *Amstelodami* (1630) ex officina Guiljelmi Blaeuw." "Virginiæ item et Floridæ, Americæ provinciarum, nova descriptio. (Par Mercator, 1630.)"

The following notice of Blaeu is found in Muller's Catalogue, *Amsterdam,* 1877: "William Jansz. Bleau commenced his renowned cartographical publications in the early years of the 17th century; in 1606 he had already published a map of the world, followed by several other separate maps, which he united in 1631 into an atlas entitled: *Appendix Theatri Ortelii et Atlantis Mercatoris,* containing 103 maps. The work, now of the utmost rarity, forms the starting point for Bleau's set of atlases. The firm of *J. Jansonius* and *H. Hondius,* who had continued to publish the old maps of Mercator and *Hondius,* tried in vain to beat the new competitor by editing a similar appendix of 106 maps in 1633. Both *Jansonius* and *Bleau* continued in doing their utmost to outdo each other by enlarging, correcting and refining their atlases, even by pirating each other's publications, until that of *Janssonius* reached at last its *tenth* volume (the *Orbis Antiquus*), to which he afterwards (in 1661) added *Cellarius, Harmonia Macrocrosima;* the atlas of Bleau reached the highest pitch by the magnificent Latin edition of 1665, in eleven volumes, to which he added the *Theatrum Urbium*

(of the 17 States of the Netherlands) in two volumes; that of Savoye and Piemont in two volumes, and of Italy, with Naples, in three volumes, all large folio.

1630.

Mercator's Atlas, Editio decima, 1630, contains a map entitled "Virginiæ item et Floridæ Americæ Provincearum, nova Descriptio." The part relating to Virginia is taken from With's map, with two important omissions—"Roanoac" and "Hatorask"—and no additional information.

1631.

Smith's map, from the original impression without the additions, is found again in "Newe welt vnd americanische historien. Durch Johan Ludwig Gottfried (*pseud.* of Johann Philipp Abelin). fol. *Franckfurt,* 1631, pp. 558-559."

1634?

Carte particolare delle Virginia Vecchia a Nuova: D'America, Carta III. A. Lucini fece, 1634? This title is taken from Catalogue of the New York State Library, 1856.

1635.

"LORD BALTIMORE'S MAP."

In 1635 was published for the benefit of "Adventurers" wishing to emigrate to America, a pamphlet entitled: "A Relation of Maryland; Together with A Map of the Country, The Conditions of Plantation, His Majesties Charter to the Lord Baltemore, translated into English. These Bookes are to bee had, at Master William Peasley, Esq; his house, on the back-side of Drury Lane, neere the Cock-pit Playhouse; or in his absence, at Master Iohn Morgan's house in high Holbourn, over against the Dolphin, London, September the 8. Anno Dom. 1635. 1 p. l. 56, 25 pp. sm 4°. 1 fold. map."

This pamphlet is the second one relating to Lord Baltimore's Maryland colony, the first having been published in 1634, entitled: "A relation of the successful beginnings of the Lord Baltemore's Plantation in Mary-land, being an extract of certaine

letter's written from thence by some of the Adventurers to their friends in England. (London) Anno Dom. 1634. 1 p. l. 14 pp."

Notwithstanding the statement on the title-page of it, "Being an extract of certaine Letters, written from thence, by some of the Adventurers to their friends in England," I am inclined to believe, from a careful perusal of the pamphlet, that it was written by one person, who at end dates his letter "From Saint Mairie's in Maryland, 27 May 1634."

The pamphlet mentioned as having been published in 1635 borrows considerably from the one of 1634, but not enough to regard it a revised edition, so it must be considered as separate and distinct and, from internal evidence, compiled in England, either by or under the direction of Cecilius Calvert, second Lord Baltimore.

The map was published with the pamphlet of 1635, as mentioned on the title; few editions, however, are known in which the map is found. The Library of Congress has a perfect copy, and a facsimile is found in "Maps to accompany the report of the commissioners on the boundary line between Virginia and Maryland, 1873." A reprint of the Relation with the map was made by Francis L. Hawks in 1865.

The map was evidently made for the guidance of the "Adventurers," as the places mentioned in the pamphlets of 1634 and 1635 as having been discovered and named are all given on the map.

The following is a full description of the map with the names of all places on it. "Noua Terræ Marie tabula." On the right, the coat-of-arms of Great Britain, and also of the house of Baltimore and the title "Novæ Angliæ pars." To the left the text: "This Northerne part of Virginia (the limitts whereof extend many degrees farther southwards) is heere inserted for the better description of the entrance into the Bay of Chesapeack." At the bottom: "T. Cecill sculp." and Delaware Bay is mentioned for the first time, I think, on a map under that name. On the west of Chesapeake Bay are given C. Henry, Iames flu., Iames towne, Point Comfort, Pamunkey flu., Rapahanock flu., Cinquak, St. Gregories poynt, Patowmeck flu., Patowmeck, St. Michaells poynt, Augusta Carolina, St. Maries, St. Geo. flu., Heron Iland, S. Clement Ile., Cedar poynt, Portobacke, Pascatoway, Patuxent

flu., Patuxent, Matapanian. On the east of Chesapeake Bay, Smiths Iland, C. Charles, Accomack, Wigco flu., Watkins point, Monoponson, Wicomese, Susquehannocks, Matsopongue flu., Fets Iland, Chingoto, Delaware Bay.

See title under 1671 for a revised copy of this map.

1636.

In "Historica Mondi: or Mercator's Atlas, Lately rectified by the studies industry of Irdocos Hondy. Englished by W. S. (i. e. Wye Saltonstall) 2d ed. fol. *London*, 1637" (on engraved title) is an inserted map of "Virginia. Ralph Hall sculpist. 1636." This is a reduced copy of John Smith's map, with localities scattered around more at the discretion of the engraver than from any geographical accuracy. The Rappahannock river is here called "Pembroke R." The other map in the text, "Virginia et Florida," is copied from With's map of 1585. On the errata leaf at end of the above-mentioned volume is this information: "In Page 905 for the Description of New Spaine read New Virginia, but there is no Map for Virginia in regard there is a more exact Map drawing in that Country, whose Platforme is not yet come over, but when it comes, every buyer of the Booke shall have it given him gratis."

Lowndes, in his "Bibliographers' Manual," mentions an edition of 1635 with maps, "one of Virginia, with head of Captain John Smith."

1639.

Posthumus' Catalogue, *Amsterdam*, 1887, p. 55, gives the following titles: "Pascaert van Nieuw Nederlandt, Virginia, ende Nieuw Engelandt, verthonende alles wat van die Landen by see oft by land is ondect oft bekent. (Routier de la Nouv. Néerlande, Virginie et Nouv. Angleterre offrant tout ce qui a été découvert ou connu de ces pays par mer et par terre.) Carte manuscrite par (Joan Vingboons), 1639."

"Powhattan, Wingandecoa bij de Engelsche Virginia. Carte manuscrite par (Joan Vingboons), 1639. Carte des côtes avec plusieurs noms de villages des indigènes. Carte van de rivier Powhatan in Virginia. Carte manuscrite du Potomac de la baie jusqu'à Beremotho Citie, par (Joan Vingboons), 1639"

1640.

Nova Virginiæ tabula. Petrus Koerius Caelavit (1640). Title from Dufossé's Americana, 6e série, No. 2.

1640-1650.

Three maps relating to Virginia are of interest in Jansson's Nous Atlas sive Theatrum Orbis Terrarum. fol. 6 v. Amstelodami, 1640-1650. I have only been able to examine the Spanish edition, entitled "Nuevo Atlas; o' Teatro de todo el Mundo. 4 v. fol. *Amsterdam*, 1653," but judge the maps are the same in both editions. These are all found in volume second. The first, called "Virginiæ partis australis, et Floridæ partis orientalis interjacentiumjz regionum nova descriptio," contains very little of what is now Virginia. "Chesapeacke Bay" is so called, and the coast is given to "C. Francois." Another, entitled "Nova Belgica et Anglia Nova," gives the coast from Nova Scotia to "C. of Feare." Delaware River is called "Zuydt Rivier." Both these maps have been compiled from English and Dutch sources. A copy of John Smith's map from his first impression is also given, with the omission of Winstons Isles, Brookes Forest, Gunters Harbour, Tauerners roads, Burtons Mount, Democrites tree, Sparkes content, Featherstones Baye, etc.

1642.

Nova Virginiæ tabula. *Amstelodami, ex officina Henrici Hondii* (1642). Title from Dufossé's Americana, 6e série, No. 2.

1651.

To a woman, Virginia Farrer,* we are indebted for a map of Virginia, which is a curious combination of fact and fiction, and strikingly shows the ignorance of the mother-country in regard to the geographical position of her new colony in connection with "the sea of China and the Indies," which is placed west of

* Since writing the above I find the Lenox Library, New York, has good copies of the Farrer maps.

"Ould Virginia and new." The Potomac river at its mouth is called "Maryland River," and the Carolinas "Rawliana." At the top of the map is a medallion portrait of Sir Francis Drake, and underneath the text: "Sir Francis Drake was on this sea and landed An° 1577 in 37 deg. where hee tooke Possession in the name of Q. Eliza: calling it new Albion. Whose happy shoers (in ten dayes march with 50 foote and 30 horsemen from the head of Ieames River, ouer those hills and through the rich adjacent Vallyes beautyfied with as proffitable rivers which necessarily must run to peacefull Indian sea,) may be discovered to the exceeding benefit of Great Brittain, and joye of all true English."

In the right corner is the title: "A mapp of Virginia discouered to ye Hills, and in it's Latt: From 35 deg: & ½ neer Florida, to 41 deg: bounds of new Englands. John Goddard sculp. Domina Virginia Farrer Collegit. Are sold by I. Stephenson at ye Sunn below Ludgate: 1651."

I have not been able to see an original copy of this map, so my knowledge of it is from a facsimile published in Justin Winsor's Narrative and Critical History of America, vol. 3, p. 465.

About all we know of Virginia Farrer is that she was the daughter of John Farrer and niece of Nicholas Farrer, of Little Giddings fame, and at one time connected with the London Virginia Company. She remained a spinster, and died January 17, 1687. Besides the map of Virginia, she seems to have identified herself with the culture of the silk-worm. Her writings on this subject are embodied in a compilation of Samuel Hartlib, entitled "The reformed Virginia silk-worm, or, a rare and new discovery of a speedy way, and easie means, found out by a young lady in England, she having made full proof thereof in May Anno 1652. *London*, 1655."

The Farrer family, who formed a little colony unto themselves in "Little Giddings," Huntingdonshire, England, seem to have occupied themselves at various literary pursuits, and to this early training Virginia Farrer was indebted for much miscellaneous information.

The following is from the "Dictionary of National Biography," in the notice of Nicholas Farrer: "It was one of Farrer's principles that every one should learn a trade, and the trade

practiced at Little Giddings was that of book-binding. An ingenious book-binder was entertained to instruct the whole family in the art of binding, gilding, lettering, and pasting—printing by the use of the rolling press."

In "the Huth Library" catalogue, 1880, the following information is given of the volume in which the map of Virginia was published: "In the next year a third title was given to the book as follows: Virginia in America, Richly Valued: More especially the southerne Parts. With the Tendure of the Vine and silk-worms (etc.) Together with A compleat Map of the Country from 35. to 41. Degrees of Latitude discovered, and the West Sea. London, printed for John Stephenson 1651."

"This copy has the title to the issue of 1651 inserted, and the map by Goddard in two states. 1. On thin paper, without the oval portrait of Sir Francis Drake, and without some of the names of places which are added in the other. The imprint is: *John Farrer, Esq. Collegit. Are sold by J. Stephenson,* 1651. 2. On thick paper, with the portrait of Drake at the top towards the left-hand corner, many names of places filled in, and the imprint varied, *Domina Virginia Farrer Collegit, etc.*"

In reading the above an explanation is found and the critic criticised for an article in "The Gentleman's Magazine," August, 1840, pp. 163-167, entitled "An examination of Beauchamp Plantagenet's Description of the province of New Albion. By John Pennington. *Philadelphia,*" 8vo, to this effect: "In the same page mention is made of an old map, which the author says is the only one in which he has found the Province of New Albion admitted. It is "A Mapp of Virginia discovered to ye Falls [not Hills, *as misprinted by Mr. Penington,*] and in latt: from 35 degr. and ½ neer Florida, to 41 deg. bounds of New England. Are sold by I. Stephenson, at ye Sunn below Ludgate 1651." Of this map we have seen a copy in the volume of New England tracts at the British Museum, already mentioned. It was published in one of them, entitled "The Discovery of New Brittania," printed at London in 1651. At the corner is inscribed "John Farrer, Esq. Collegit," which our author misprints "Domina Virginia Farrer Collegit."

Knowing from the Huth catalogue above referred to, of two maps engraved, one with the name of John Farrer, the other with

that of Virginia Farrer, we can easily see how the critic was hasty in criticising John Penington's book.

In the tract mentioned in the above criticism, called "The discovery of New Brittaine, 1651. By Edward Bland," I find in the British Museum catalogue mention of two copies, with the following notes attached to each title: "The map in this copy, has a portrait of Sir F. Drake at the top," "In the map in this copy the medallion portrait of Sir F. Drake is omitted, and there are other variations."

We have in this tract evidently run against the Farrer maps of Virginia, and the question is whether they were originally published in this tract or afterward inserted by some one unknown. The Williams and Bland tracts were published the same year, 1651, and by the same publisher, John Stephenson.

The following interesting note is taken from the Quaritch catalogue, No. 112, Part 2, May 16, 1891, pp. 158-159:

"Williams was the author of the book; but Mr. John Farrer, to whom he alludes in the preface, supplied all the material. No map was issued with the first edition *nor yet with the second, but Farrer's MS. design* was engraved with slight alterations in 1651, for issue with the third edition in that year."

"The distortion of geographical truth in the map, taken in connection with the MS. notes (in which the writer complains bitterly that Williams had omitted a good deal of the original matter, so as to serve the interests of the new Carolanians rather than those of the old Virginians), shows that one powerful idea in Mr. Farrer's mind was to unite New Albion (California) with Virginia. In fact, he says that a small expedition would be able to march in eight, ten, or fourteen days from the Virginia settlements to New Albion, by which he meant the New Albion (Upper California) of Sir Francis Drake (1578) on the Pacific coast. The MS. notes and the printed text itself prove that something had been heard of the great Mississippi river, which it was supposed fell into the South Sea."

1657.

Quaritch's Catalogue, No. 11, April, 1891, page 15, mentions a manuscript map (now in the Lenox Library, New York), the title of which, and note attached, I copy for obvious reasons:

"Manuscript map of the South Part of Virginia, *the original coloured drawing* (18¾ inches by 14), with artist's signature," Nicholas Comberford, Fecit Anno 1657, mounted on oak boards hinged to close as a folio book. (Note.) The words "now the north part of Carolina" were added about 1670 underneath the original title. This is consequently the first special map of North Carolina, the separation of which was looked upon with great disfavor by the planters of "Ould Virginia." The coast-line extends from Cape Henry to Cape Fear, and the interior is delineated to as far as from about Murfreesboro in the north to about Elizabeth Town in the south. This is an article which ought to be secured by a public library. It is remarkable that it was prepared in 1657, six years before the patent was given by Lord Clarendon and others for the establishment of a colony."

1659.

Novi Belgi, Novæ Angliæ, nec non partes Virginiæ Tabula. Van Nich. John Visscher. Amsterdam, 1659. This map is noticed further on in a reprint from Asher's "A list of the maps and charts of New Netherland."

1661.

Arcano del Mare di Don Roberto Dudleo Duca di Nortumbria e Conte di Warwich, impressione seconda (etc.) 2 v. Fol. *Fiorenza,* 1661. Quaritch Catalogue, No. 362, June, 1885, states: "The maps which depict Virginia, New Netherlands and New England are among the most important of these; they are fuller and upon a larger scale than, which at the same time they are totally distinct from, those of Laet, Jansson, Mercator, Visscher, the Beschryving of 1651, Van Loon and Donckers. The above second edition was prepared from the author's corrected copy of the first (1646), and as he died in 1639, his maps of those parts of America must be considered to take precedence of all those mentioned by Asher, except the 1630 edition of Laet."

1667.

Bleau's Le Grand Atlas. Fol. *Amsterdam,* 1667, v. 12, gives the same maps as are before mentioned in Jansson's Novus

Atlas, 1640-50, i. e., Virginiæ partis australis, et Floridæ partis orientalis, interjacentiumjz regionum Nova Descriptio," "Nova Belgica et Anglica Nova," and also John Smith's map.

1670.

We have seen the influence on the cartography of Virginia of John With's map of 1585 and John Smith's map of 1608.

I come now to the one made by Augustine Herman in 1670 and engraved in 1673, which, with the two maps just mentioned, were copied by all map-makers up to Fry and Jefferson's map of 1751. Herman's map was little known in this country until 1873, when a reduced facsimile was made from the original copy in the British Museum and published in the "Maps to accompany the report of the commissioners on the boundary line between Virginia and Maryland. Richmond, 1873."

The influence of this map on the cartography of Virginia can be traced in several maps which I will mention hereafter.

The following notice of Herman is taken from a note on page 230 of "Memoirs of the Long Island Historical Society," vol. 1, 1867:

"Augustine Hermans, or Heermans, called also Harman, was a Bohemian by birth, but came from Holland to New Amsterdam in or before 1647, in which year he was appointed by the director and council of New Netherland, one of the Nine Men, a body of citizens selected to assist the government by their counsel and advice. He came over to this country as a clerk to John and Charles Gabry of Amsterdam. He was sent, in company with Resolved Waldron, by the Dutch government, to the Governor of Maryland, to confer in relation to the claim of title to the proprietor of Maryland to the South river. This no doubt led to his subsequent settlement on Bohemia river, so named by him, in that province. He seems to have been a surveyor and draughtsman. In addition to the map of Maryland, stated by our journal to have been made by him, which seems to have been the consideration for the grant of Bohemia manor, he made a sketch of the city of New Amsterdam, which was engraved on Nicolas Jan Visscher's map Novi Belgii Novæque Angliæ nec non partis Virginiæ, published in 1650-6, and also on reduced scale from Visscher's map on the

map prefixed to the 2d ed. of Vanderdonk's Description of New Netherland.

"The Dictionary of National Biography" says: "Faithorne engraved two large maps, viz.: 'An exact Delineation of the Cities of London and Westminster . . . . by Richard Newcourt. This exceedingly rare map, of which the only impression known is preserved in the department of prints, Bibliothèque Nationale, Paris, is composed of twelve sheets, which, when placed together, measure 72 inches by 39 inches. In May, 1857, Messrs. Evans published a facsimile of it. In 1878, Mr. Stanford, of Charing Cross, published another facsimile, engraved by George Jarman. The other map is that of Virginia and Maryland, four sheets; when put together measures 36 inches by 31 inches. In the centre, above, are the royal arms of Great Britain; towards the right, below, is a portrait, on a pedestal, of Augustine Hermann, who was appointed by the Dutch in 1659 ambassador to Maryland. This map, said to be unique, is preserved in the Grenville Library, British Museum.

The following is the full title of the map:

"Virginia and Maryland. As it is Planted and Inhabited this present year 1670. Surveyed and exactly Drawne by the Only Labour & Endeavour of Augustin Herman Bohemiensis. Published by Authority of His Maties Royall License and particular priviledge of Aug. Herman and Thomas Withinbrook his Assignee for fourteen yeares from the year of our Lord 1673. W. Faithorne sculpt.

The grant for exclusive publication of this map may be found in the Calendar of State Papers, Colonial America and West Indies, 1669-1674, page 551, and is here inserted:

Jany 21. 1674.
Whitehall.

1210. Grant to Augustine Herman of the privilege of the sole printing of his map of Virginia and Maryland. Whereas he has by the King's command been for several years' past engaged in making a Survey of his Majesty's countries of Virginia and Maryland, and hath made a map of the Same, consisting of four Sheets of paper, with all the rivers, creeks and Soundings, etc.,

being the work of very great pains and charge, and for the King's especial service; and whereas the copying or counterfeiting said map would be very much to said Herman's prejudice and discouragement, all his Majesty's Subjects are hereby Strictly forbidden to copy, epitomize, or reprint, in whole or in part, any part of said map, within the term of fourteen years next ensuing without the consent of said Herman, his heirs, or assigns. [Dom. Entry Bk., Chas. II Vol XXXVI, p.p. 323, 324.]

In the New York Sun of October 23, 1892, an article entitled "Lord of Bohemia Manor," gives the most exhaustive account of Herman, which the editor of that paper has kindly permitted me to republish. The author, E. N. Vallandigham of New York, is indebted to Lednum's Rise of Methodism in America, and Vincent's History of Delaware, for considerable information.

LORD OF BOHEMIA MANOR.

Augustine Herman, an Early Hero of New York and Maryland.

Story of a Seventeenth Century Merchant who became a Great Landowner and Baron on the Delaware Peninsula.

Down on the west side of Pearl street, at or near the corner of Pine, there stood some 250 years ago a fine old-fashioned mansion with orchard and gardens, and in this mansion dwelt the man who was probably the first person to become a legally naturalized citizen of this country. He was not of Dutch blood, though he became one of the "Nine Men" who constituted the council to the Governor of New Netherlands. Augustine Herman was the name of this alien who helped to govern the Dutch colony. He was a Bohemian, born in Prague, now almost two and three-quarter centuries ago. Augustine Herman was a strenuous character of broad grasp, of bold conception, of enormous energy, and of marvellous courage. He was all his life in some sort a merchant, yet he came to be a great land-holder, and he was one of the few Americans to bear a title and to be recognized as lord of the manor. Herman is forgotten as a New Yorker, though his early services were such as to indicate that he was a man of considerable importance during his residence here, but he is a local hero in the region which he named in memory of his birthplace, Bohemia Manor. He is credited by some with having been the "first beginner of the Virginia tobacco trade," and with having successfully experimented in indigo culture near this city. He was, besides, a man of education, a surveyor by profession, a skilled draughtsman, and a trusted diplomat.

When Peter Stuyvesant found Lord Baltimore laying claim to the Dutch possessions on the Delaware he sent Herman and Resolved (or Rosevelt) Waldron to St. Mary's, in Maryland, in order that some sort of treaty might be made with the Englishman. Herman went as the diplomat, Waldron as his interpreter. Herman was so pleased with what he saw of Lord Baltimore's possessions that he wrote to say that if Lord Baltimore would grant him a manor he would make for his Lordship a map of Maryland. Lord Baltimore assented to this, and if Herman could have really made Lord Baltimore the proprietor of all that was included in Herman's map, the price which was paid, 20,000 acres of the finest land between Delaware and Chesapeake bays, would have been sufficiently small. Herman's map included not only all of Maryland as it now is, but also all of Delaware and a part of Pennsylvania. It was this map, doubtless, that figured on Lord Baltimore's side in the conflict over the survey of Mason and Dixon's line.

The noble estate that Herman received for this feat in map-making lay in Cecil County, Maryland, and New Castle County, Delaware. It is still called Bohemia Manor, and when people in the northerly part of the peninsula speak of "the manor" they mean the territory over which Herman ruled. Here Herman built a great house, carried on a large trade with the Indians, dabbled in affairs of State, and exercised a wide hospitality. Here, too, he led a wretched life with a shrewish second wife. Here is his tomb, and one may still see traces of the manor house and the deer park hard by. Herman, two of his sons, a grandson, a great-grandson, and two great-great-grandsons were successively lords of Bohemia Manor. Of the last two lords of the manor, one was killed by a fall from his horse, and the other was an idiot, who was wont to insist upon his title, and drawing a circle about himself in the soil of his domain, would forbid the approach within its circumference of any who denied his lordship. The heirs fell to quarrelling over the estate, and the legal existence of Bohemia Manor ended 128 years after its founding by Augustine Herman.

Augustine was the only strikingly forceful man of the line. His story reads like a romance, but at this distance of time it is hard to sift out truth from fiction, for the man so impressed those about him that all sorts of wonderful legends touching his adventures have come down in local history. There are conflicting traditions as to the reasons for Herman's desertion of New York. One story is that he and Stuyvesant quarrelled over the map made for Lord Baltimore. Another is that the two were rivals in love, and that Herman was successful. The latter is hardly true, for Herman was married in 1651, and for nearly ten years afterward he was at times employed in various important missions by the Dutch authorities. He is known to have passed through some sort of bankruptcy proceedings in New York, and possibly out of this fact grew the most astonishing of all the stories preserved in the local traditions of Bohemia Manor.

According to this story, Herman returned to New York, some time after his settlement in Maryland, to find his estate in this city seized by a squatter, and when Herman protested he was himself placed under arrest. He feigned insanity, the story goes, and refused to be parted from the horse which he had ridden all the way from Bohemia Manor. Accordingly he was bidden to ride his horse to the second story of a stone warehouse, where he and the horse were securely locked in. But when all his enemies had departed, Herman mounted his horse and rode straight at the closed window of his prison. Horse and man went through the window and landed safe on the stones below, but with such force that blood gushed from the nostrils of the horse. The escaping prisoner then rode straight to the Hudson, swam his horse to the Jersey shore, and in due time arrived at Bohemia Manor, having in the course of his journey swam also the Delaware on the back of his horse. One legend is that the animal died soon after this second feat; the other, that he carried his master straight to the manor house. It is entirely probable that Herman was arrested at the suit of a creditor, and that fearing the tender mercies of the Dutch Government, he managed to escape on his horse. At any rate there are two or three pictures extant of Herman and his horse, the master being represented as standing beside the horse, with the blood of the faithful creature reddening his hands. It is pretty well authenticated that Herman himself caused at least one of these pictures to be painted. This portrait of Herman shows a powerful Teutonic face. He is clean shaven, his mouth is firm, his eyes are piercing, his cheek bones are high. His hair, parted in the middle, falls in thick masses to his shoulders. He wears a red frock coat ruffled at the wristbands, and a full white tie that falls upon his bosom.

Whatever Herman's quarrel with the Dutch, he was evidently on good terms with the English conquerors of New Amsterdam, for in 1671 the authorities at New York gave orders that those at New Castle, Del., should clear half the way for a road from that town to Herman's plantation. The people of Maryland were to clear the other half. But Herman himself had larger schemes that a mere traffic by wagon road, and he is believed to have projected a canal to connect Delaware and Chesapeake bays, an idea realized in the present Chesapeake and Delaware ship canal. Herman's friendship with the English conquerors of the Dutch possessions in North America seems to prove that he had lost favor with the Dutch, and an uncommonly interesting fact seems to furnish proof that he needed other protection than that which he had enjoyed while an agent of the Government at New Amsterdam, for in 1660 he applied to the Council of Maryland for a patent of naturalization, and in that year he and his five children received such patents. They seem to have been the first persons to have been naturalized by an American colony.

Herman, after his naturalization, received what Lord Baltimore did not really own according to later treaties, the manor of St. Augustine, extending from the shore of Delaware Bay through to the line of Bohemia Manor. He willed this to one of his sons, but the family never made

good the title to the whole grant, for this region was afterward adjudged part of Penn's territory. St. Augustine creek flows through the manor. The will of Herman is on file in the archives of New Castle County. His sons, took an active part in the affairs of Delaware until one after the other they were called to assume the lordship of Bohemia Manor, and to live in the great manor house.

There is a picturesque side light upon Herman's character to be obtained from the annals of those Christian Socialists of the seventeenth century, the followers of Jean de Labodie, successively an apostate to the Jesuits and to the Protestants. Some years after Herman had set up as lord of Bohemia Manor, Brothers Sluyter and Dankers of the Labodists came to the peninsula of Delaware seeking converts and a home for their society. Just about the time they fell in with Herman they had persuaded Samuel Bayard, of the family distinguished in New York and Delaware, to join them, and they had hopes of making even Herman a convert. But they declare in their journal that they found him, though kindly disposed to them personally, a worldly person, by no means to be won over. Herman did, however, deed to the Labodists in 1684 3750 acres of the manor, and to this day the land is called "the Labodie tract." Sluyter and Dankers set up a Christian Socialist colony there, and were joined by several families from New York. Sluyter proclaimed himself bishop of the flock, and set up his wife as a sort of abbess. Part of the community from Wiewert, in Denmark, came over to join the new society. They built a large house and cultivated the land. Everything was in common. The men and the women took their meals in separate apartments, and no person spoke at table. It often happened that a man dined for months without knowing the name of the next man at table. They eschewed all outward show, and were pledged to give up the world.

Herman never had the slightest leaning toward the Labodist faith, and he came to repent having made a place for the colonists, as his son joined the society, and, at the instigation of its leaders, deserted his unbelieving young wife. The lands of the society were eventually partitioned, and some of the wealthiest of Maryland families are descended from these, perhaps the first Christian Socialists to organize an industrial society in America.

By the year 1684 Herman, wearied toward the close of a feverish life, harried by claimants to part of his great estate, and unhappy because of his wife's temper, invested his son with the manor by deed of enfeoffment. The provisions of this deed give one a notion of the state proper to an American lord of the manor in the latter part of the seventeenth century. The consideration to be paid annually by the son was:

"Five thousand pounds of good, sound, and merchantable tobacco and casks, and also six barrels of good beer and strong beer, one anchor of rum or brandy, one anchor of spirits, two anchors or twenty gallons of good wine, and one hogshead of the best cider out of the orchard, and one cwt. of good muscovado sugar for my particular private spending; and lastly, if I should remove with my abode to any other place in the

country from off the manor, then he, my son, is obliged to pay toward my said board the sum of 2000 pounds of tobacco and casks, and if I should happen to go to New York, then my son is to furnish me with £25 in money."

Herman's great desire was to be the founder of a baronial family. His will provided that whosoever in the future should inherit the lordship of Bohemia Manor must add to his Christian name that of Augustine, or forfeit the inheritance to the next heir. He finally provided that heirs male to the estate failing, it should go to found a free school and college of the "English Protestant Church," under the perpetual name of Augustine Bohemia. His will also provided for an elaborate tombstone, with a proper inscription. This stone of oolite, as are the stones hard by marking Mason and Dixon's line, an outgrowth of the very controversy that first brought Herman to Maryland, was removed from his grave and used as a door for the family vault of the Bassetts, then living on a portion of the manor, and in this vault was laid the body of James A. Bayard the elder. After Mr. Bayard's body was removed to Wilmington, Herman's tombstone fell to the ground and was broken. The inscription, which was cut by a workman who did not know how to spell manor or Bohemia, who is believed to have misspelled the name of the dead man himself, and who blundered by a year in the date accompanying the inscription, reads thus:

AVGVSTINE HERMEN,
Bohemian.
The first fovnder.
Seater of Bohemia Mairor.
Anno 1661.

The lands of which Herman was lord are perhaps the finest on the Delaware peninsula. They lie mainly on the slope of the Chesapeake, traversed by the marvellously clear and beautiful tide-water streams characteristic of the region, dotted with fine old country homes and showing evidence on every side of a long established civilization. Some descendants of the first lord still live upon the manor, but the name has long been extinct. The wife of John Randolph and the wife of Benedict Arnold were both descended from Herman.

1671.

Noua Terræ-Mariæ tabula. *In* OGILBY (John) America; being the latest and most accurate descriptions of the new world. fol. *London, by the author*, 1671, between pp. 182-183.

This map is the same as published in "A relation of Maryland, 1635," with various additions of counties, towns, &c. "Pamunkey flu" is on this called "Yorke flu."

1671.

Smith's map, first impression before the additions, is also found in Montanus' De nieuwe en onbekende weereld of beschrijving von Amerika. fol. T'Amsterdam, 1671. In Ogelby's America, which is an English translation of the above, the same map is given.

1675.

Between pages 58-59 of Arent Roggeveen's "Het eerste deel von het Brandende Veen, verlichtende geheel West-Indien (etc.), fol. *A'Amsterdam, Peter Goos* (1675)," is a map called "Pascaerte vande Virginies Van Baija de la Magdalena tot de Zuijdt Revier." The influence of John Smith's map is again traced, combined with Dutch additions, near Zuijdt or Delaware river.

1675.

A chart of the sea coasts of New England, New Jarsey, Virginia, Maryland and Carolina, from C. Cod to C. Hatteras. By John Sellar. (In his Atlas maritimus, fol. *London, J. Darby, for the author*, 1675, No. 43.)

1676.

"A map of Virginia and Maryland. Sold by Thomas Basset and Richard Chiswell. F. Lamb sculp."

This map is found between pp. 43-44 of "A Prospect of the most famous parts of the World. By John Speed. New ed. fol. London, for T. Bassett & R. Chiswell, 1676.

There has been considerable discussion as to where the publisher of the above map found his authorities. On examination, I find it was taken from Herman's map of 1670, with various changes and omissions.

1679.

"A new map of the English Empire in America, viz: New England, New York, New Jersey, Maryland, Virginia, with an accurate description of those countries, by R. Daniel, Esquire.

Title from English Catalogue, No. 21, 1679.

1680?

A new map of Virginia, Maryland and the improved parts of Pennsylvania, and New Jersey. London, sold by Christ. Browne, circa 1680. Title from Muller's Catalogue, 1890.

1682.

A map of Maryland and Virginia in 1682. James Bowden del. 10½x8 inches. [*In* BOWDEN (James). The history of the society of friends in America. 8°. *London, C. Gilpin,* 1850. v. 1. 339.]

1690-1695?

"Virginia, Maryland, Pennsilvania, East & West New Jarsey, By John Thornton at ye Platt in the Minories. And by Will Fisher at ye Postorn Gate in Tower Hill, London." And, "A new map of New England, New York, New Iarsey, Pensilvania, Maryland and Virginia. Sold, by Iohn Thornton, Robt. Morden, and by Phillip Lea, London."

The first map of the above two is mentioned in the British Museum Catalogue of Maps as published 1704? I think, however, this date late by several years, and would place them both from 1690 to 1695. The last mentioned map gives the "partition line of East & West Jarsay," and is a very comprehensive map for the time. They borrow considerably from Herman's map of 1670.

Also about this time "A map of ye continent of America; viz: Virginia, Maryland, Carolina, New York, (etc) W. Binneman sculpsit. Sold by R. Morden. London; and "A new map of the english empire in America, viz. Virginia, Maryland, Carolina, (etc.) by Rob. Morden. I. Harris sculp. London, R. Morden & C. Brown.

The following titles are taken from G. M. Asher's "A list of the maps and charts of New Netherland," where they are fully discussed and to which I refer the reader:

"Novi Belgie Novaeque Angliae nec non Partis Virginiae Tabula multis in locis emandata a Nicolao Joannis Visschero."

"Novi Belgii Novæque Angliae nec non Partis Virginiæ Tabula multis in locis emandata a Hugo Allardt."

"Belgii Novi Angliæ Novæ et Partis Virginiæ Novissima Delineatio *Prostant Amstelodemi apud Petrum Schenk et Gererdum Valk.*"

"Novi Belgii novaesque Angliae nec non Pennsylvaniae et Partis Virginiæ Tabula multis in locus emandata a Justo Donckers.

1700?

Carte nouvelle de l'Amérique Angloise, contenant la Virginie, Mary-land, Caroline, Pensylvanie Nouvelle Iorck, N: Iarsey, N: France, et les terres nouvellement découverte dressée sur les relations les plus nouvelles. Par le sieur S. (Sanson, *anon*) *Amsterdam, P. Mortier.*

This map is mentioned in Dufossé's Americana, No. 7-12, with date 1690.

1700?

Carte particulière de Virginie, Maryland, Pennsilvanie, la Nouvelle Jarsey Orient et Occidentale. *P. Mortier, Amsterdam.*

Title from British Museum Catalogue of maps, 1885.

1708.

A new map of Virginia and Maryland. By H. Moll.

(*In Oldmixon* (John) The british empire in America. 12°. *London, for J. Nicholson,* 1708. v. 1, p. 209.)

A reduced copy of Herman's map.

1715.

A new and exact map of the dominions of the king of Great Britain on ye continent of North America. Containing Newfoundland, New Scotland, New England, New York, New Jersey, Pensilvania, Maryland, Virginia and Carolina. By Herman Moll, 1715. (*London*) T. Bowles, (etc. 1730.)

1717.

A new map of Virginia, and Maryland. By H. Moll, geographer. (At left hand corner, vol. 1, Page 209).

(*In Atlas* Geographus: or, a compleat system of geography. 4°. *In the Savoy. E. Nutt for J. Nicholson,* 1717. v. 5, p. 700.)

A reduced copy of Herman's Map. "vol. 1, Page 209" refers to Oldmixon's British empire in America, 1708, where this map was originally published.

1719.

A new map of Virginia, Mary-land and the improved parts of Penn-sylvania & New Jersey. Most humbly Inscribed to the Right Hon'ble the Earl of Orkney & Ct. Knight of ye most Noble and Ancient Order of ye Thistle 1719. Revised by I. Senex.

(*In New* (A) general atlas. (*anon*) fol. *London*, for D. Browne, 1721. facing p. 240.) Mostly taken from Herman's map.

1719.

A new map of the english empire in America. viz: Virginia, Maryland, Pennsylvania, New York. (etc.) Revis'd by I'no Senex. 1719. I. Harris sculpt

(*In New* (A) general atlas. (*anon*) fol. *London, for D. Browne*, 1721. facing p. 236.)

1720.

'T noorder gedeelte van Virginie door Bartholomeus Gosnal en Martin Pringe uyt Engeland bevaaren. *Uytgevoerd te Leyden door Pieter van der Aa*, (1720).

1732-3.

To the Merchants of London, trading to Virginia and Maryland this mapp of the Bay of Chesepeack with the rivers Potomock, Patapsco and part of Chester is dedicated by Walter Hoxton.

British Museum catalogue has this 1750? William's "Maps of Maryland," as above.

1735.

A map of Virginia according to Captain Iohn Smith's map Published Anno 1606. Also Of the Adjacent country called by the Dutch Niew Nederlant Anno 1630. By Iohn Senex.

(*In short* (A) account of the first settlement of the Provinces of Virginia, Maryland, New York, New Jersey and Pensylvania,

by the English. To which is annexed A Map of Maryland, according to the Bounds mentioned in the Charter and also of the adjacent Country, Anno 1630. 4° London, 1735, at end.)

1736.

Eden in Virginia Von der Helvetischen societet erkaufte 33,-400 jucharten land, a. 1736.

This map is probably taken from "Neu gefundenes Eden," 1737, published by the Helvet. Soc. to induce emigration to their land in North America. A copy in the Library of Congress.

1736.

Virginia and Maryland. By H. Moll.

(*In Moll* (Herman). Atlas minor. obl. fol. *London, for T. Bowles & J. Bowles,* 1736. No. 50.)

A reduced copy of Herman's map. Also found in "Atlas Geographus 1717," on a small scale.

1736-1737.

The course of the rivers Rappahannock and Patowmack in Virginia, as surveyed according to order in the years 1736 & 1737. (*anon.*) 12x14 inches.

William Byrd in his "History of the dividing line," says, v. 2, p. 116: "According to the order of the Virginia commissioners Major William Mayo form'd a very elegant map of the whole northern neck by joining all the particular surveys together."

Winsor's Narrative and critical history of America, v. 5, p. 276-277, has a facsimile of a part of the map and states the following: "The plate of the map already referred to was corrected to conform and this additional title to it was added: A survey of the Northern Neck of Virginia, being the lands belonging to the Rt. Honourable Thomas Lord Fairfax, Baron Cameron, bounded by and within the Bay of Chesapoyocke, and between the Riviers Rappahannock and Potowmack." This map has the following text: "The Boundary line of the Northern Neck in Virginia from the Head Spring of the River Conway a Southern Branch of the River Rappahanock, to the Head

Spring of the River Potowmack arising in the Allegany Mountains as ordered by his Majesty in council 11th April 1745 unto the Rt. Hon. Thomas Lord Fairfax the Proprietor thereof."

1737.

A Plan of Potomack River, from the mouth of Sherrendo down to Chapawamsick. Surveyed 1737. B. O. Brooke. Manuscript in U. S. Coast Survey Office.

1738.

The following notice is in the Virginia Gazette: "Williamsburg, Jan. 5th, 1738. Towards the close of the last session of Assembly, a proposition was presented to the House by Mr. Joshua Fry, Major Robert Brooke, and Major Wm. Mayo, to make an exact survey of the colony, and print and publish a map thereof, in which shall be laid down the bays, navigable rivers, with the soundings, counties, parishes, towns and gentlemen's seats, with whatever is useful or remarkable, if the House should see fit to encourage the same. But as said proposition was presented too late in the session, it was ordered that the consideration thereof should be postponed to the next session of Assembly.

Slaughter, in his Life of Joshua Fry, says: "It is not worth while to say what a precious treasure such a work would have been to after generations. This proposition is not alluded to in Heming, and the presumption is, that nothing came of it. It is chiefly interesting now in connection with the map executed some years after (1751) by Fry and Jefferson, showing that Fry had such a work in contemplation many years before he made his map.

1738.

A new map of Virginia, humbly dedicated to Thomas lord Fairfax, 1738. 13x8½.

(*In Keith* (*Sir William*). The history of the british plantations in America. Pt. 1. 4° *London,* 1738.)

1747.

A new and accurate map of Virginia & Maryland. Laid down from surveys and regulated by astron'l Observat'ns. By Eman. Bowen.

(*In Complete* (A) system of geography. (*anon*) fol. *London, for W. Inns,* (etc.) 1747. v. 2, p. 647.)

From Herman's map.

1750?

A Map of Virginia and Maryland, H. Gavin sc. (*London,* 1750?)

Title from British Museum Catalogue of maps, 1885.

1751.

A map of the most inhabited part of Virginia containing the whole province of Maryland with parts of Pensilvania, New Jersey and North Carolina. Drawn by Joshua Fry & Peter Jefferson in 1751. To the Right Honourable George Dunk, Earl of Halifax. (etc.) this map is most humbly inscribed by Thos. Jefferys engrav'd and Publish'd according to Act of Parliament by Thos. Jefferys, London.

The original engraved map.

1751.

A map of the most inhabited part of Virginia (etc.) Drawn by Joshua Fry & Peter Jefferson in 1751. *Printed for Robt. Sayer & Thos. Jefferey's, London.*

(*In Jeffery's* (Thomas, *engraver*), A general topography of North America and the West Indies. fol. *London, for R. Sayer & T. Jefferys,* 1768, No. 54-57.)

1752.

Map of the Virginia and North Carolina dividing line. From a draught at the head of the following letter.

[*In* FONTAINE (James). Memoirs of a huguenot family. 8°. *New York,* 1853. Page 356.]

NOTE. The letter signed Peter Fontaine, Jr. July 9, 1752.

1752.

A new and accurate map of Virginia & Maryland. Laid down from surveys and regulated by Astron'l Observat'ns By Eman. Bowen.

(*In Bowen* (Emanuel), A complete atlas. fol. *London, for W. Innys,* (etc.) 1752. No. 59.)

Same map in "A complete system of geography," 1747.

1754.

A map of the western parts of the colony of Virginia. 7½x5. J. Gibson sculpt. Printed by R. Baldwin, in Pater Noster Rowe.

[*In* LONDON (The) magazine. 1754. 8°. *London, R. Baldwin,* 1754. v. 23. page 272.]

Illustrating the text "Some extracts from the Journal of major George Washington." This map was afterward enlarged and published in the London ed., 1754, of Washington's Journal.

1754.

Map of the western parts of the colony of Virginia as far as the Mississippi. 9x14.

(*In Washington* (George) The journal of Major George Washington sent by the Hon. Robert Dinwiddie, to the commandant of the French Forces on Ohio. 8° *Williamsburgh* [Va.] *printed, London,* reprinted for T. Jefferys, 1754. Also in reprint by J. Sabin in 1865. This map was not published in the original Williamsburg edition, but was made by Jefferys for his reprint above mentioned.

1755.

Carte de la Virginie et du Maryland, Dressée sur la grande carte Angloise de Ms. Josué Fry et Pierre Jefferson. Par le Sr. Robert de Vaugondy, Géographe ordinaire du Roi, 1755. 19x25.

(*In* ROBERT de Vaugondy (Gilles) *and* ROBERT de Vaugondy (Didier). Atlas universal. fol. *Paris,* 1757, No. 100.)

This Atlas is known under the name of "Grand Vaugondy."

1755.

A general map of the middle british colonies in America; viz. Virginia, Mariland, Delaware, Pensilvania, (etc.) By Lewis Evans, 1755. Engraved by Jas. Turner. *Philadelphia, L. Evans, and sold by R. Dodsley, London,* 1755.

(*In Evans* (Lewis) *Geographical,* historical, political, philosophical and mechanical essays. 4°. *Philadelphia, B. Franklin & D. Hall,* 1755.)

1755.

A map of Northern Virginia, Delaware, New Jersey, Southern Pennsylvania and Maryland, by J. Dalrymple. 2 col. sheets.

London, Jan. 1, 1755. "From information collected on the spot and entered in his journal."

Title from Williams' Maps of the territory included within the State of Maryland.

1755.

A map of Virginia, north and south Carolina, Georgia, Maryland, with part of New Jersey, etc. *R. Baldwin* (*London*), 1755.

Title from British Museum Catalogue of Maps, 1885.

1757.

Carte de la Virginie, de la baye de Chesapeack et pays voisins, pour servir à l'histoire générale des voyages. (1757.)

Title from Dufossé's Americana, 10e série, No. 7-12.

1758.

Virginia, Maryland, Pennsilvania, East & West New Jarsey, Sold by William Mount & Thos. Page, Tower Hill. 20x31.

(*In English* (The) pilot. The fourth book, fol. *London, for W. Mount,* (etc.) 1758. facing p. 23.)

Herman's map with some alterations.

1758.

A draught of Virginia from the capes to York in York river and to Kuiquotan or Hamton in James river by Mark Tiddeman. Sold by W. & I. Mount & T. Page on Tower Hill, London.

(*In English* (The) pilot. The fourth book. fol. *London,* for W. Mount, (etc.) 1758. facing p. 23.)

1758.

A general map of the middle british colonies in America. viz: Virginia, Maryland, Delaware, (etc.). Carefully copied from the

original published at Philadelphia, by Mr. Lewis Evans, 1755. with some improvements by I. Gibson. (*London*, 1758.)

1758.

A general map of the middle british colonies in America viz: Virginia, Maryland, Delaware, (etc.) By Lewis Evans. Corrected and improved by Thos. Jefferys. *London. R. Sayer & T. Jefferys*, 1758.

(*In Jefferys* (Thomas) A general topography of North America and the West Indies. fol. *London, for R. Sayer & T. Jefferys*, 1768. No. 32.)

1758.

Karte von der bay Chesapeack und den benach barten landen. 7½x11.

[*In* ALLGEMEINE historie der reisen zu wasser und lande. 4°. *Leipzig, Arkstee & Merkus*, 1758. v. 16, p. 538.]

Same map in the French edition "Histoire générale des voyages."

1759.

Virginia, Marylandia et Carolina in America Septentrionali Britannorum industria excultæ repræsentatæ a Ioh. Bapt. Homann S. C. M. Geog. Norimbergæ.

(*In Homann* (J. B.) Atlas geographicus maior. fol. *Norumbergæ curantibus Homannianis heredibus*, 1759.

This volume has on engraved title "Atlas Homannianus. I. Iust. Priesler del, 1762. On the map called "Dominia Anglorum in America Septentrionali," in the same Atlas, is a small map called "Virginia and Maryland," which is copy of Moll's map of 1708, found in Oldmixon's "British empire in America, 1708."

1760.

Map accompanying agreement between ld. Baltimore & T. & R. Penn, July 4, 1760.

(In Pennsylvania archives. 8°. *Philadelphia*, 1853, v. 4, front.)

1760.

North America, from the french of Mr. D'Anville. Improved with the back settlements of Virginia and course of Ohio. Illustrated with geographical and historical remarks.

(*In Jefferys* (Thomas) The natural and civil history of the french dominion in N & S America. fol. *London,* 1760. facing p. 134.)

1762.

Carte de la Virginie, Maryland, etc.; tirées des meilleures cartes angloises. (Bellin, *Paris,* 1762.)

Title from Dufossé's Americana, 10e série. No. 7-12.

1762.

Virginia. Scala leucarum & semi-leucarum.

(In Gronovius (Johann Friedrich, the younger). Flora Virginica exhibens plantas, quas Johannes Claytonus, in Virginia crescentes observavit, collegit & abtulit. (Edited by L. T. Gronovius). 4°. Lugduni Batavorum, 1762.)

1767.

A draught of Virginia from the Capes to York in York river and to Kuiquotan or Hamton in James River. By Mark Tiddeman. Printed & sold by G. Grierson at the Two Bibles in Essex Street, Dublin.

(*In English* (The) pilot. The fourth book. fol. *Dublin, B. Grierson,* 1767, p. 25.)

Same map in London ed. of 1758.

1767.

Virginia, Maryland, Pennsilvania East and West New Jarsey. Dublin. Sold by Geo. Grierson at the Two Bibles in Essex Street.

(*In English* (The) pilot. The fourth book. fol. *Dublin, B. Grierson,* 1767. after p. 24.)

Same map in London, ed. 1758. Herman's map.

1770.

I have been unable to examine a copy of Henry's map of Virginia of the above date, so inserted an interesting description from "The Historical Magazine," September, 1863, v. 7, pp. 286-288:

Henry's Map of Virginia in 1770.

The following account of this map shows that at the present time it would be of considerable interest, as the geography of that State has never been more widely studied. It would enable us to institute a curious comparison between Virginia before the Revolution and Virginia as the Rebellion found and as it will leave her.

The title-piece is characterictic of Virginia in her earlier days. It represents an arch, surmounted with a capstone, upon which is seated an Indian maiden holding in the right hand a likeness of George III., while her left encircles a cornucopia, from which Indian corn, tobacco leaves and fruit protrude, while the bow and arrows lie across the picture. The ground upon which the arch is based represents a recumbent negro, basket of fruit, Indian corn, tobacco leaves, young negro bearing fruits, hogsheads of tobacco; a ship from which the little negro seems just to have landed. The title-piece, really a beautiful piece of engraving, contains the following words:

'A new and accurate map of Virginia, wherein most of the counties are laid down from actual surveys, with a concise account of the number of inhabitants, the trade, sale, and produce of the Provinces, by John Henry.' 'Engraved by Thomas Jefferys, Geographer to the King.' 'London, February, 1770: Published according to act of Parliament for the author, by Thos. Jefferys, at the corner of St. Martin's Lane, in the Strand.'

It is a map exclusively of Eastern Virginia. That portion of the State west of the Alleghanies is marked as a wilderness, with the Kanawha spelt "Konhaway," which is traced from its rise in North Carolina to the Ohio with very great accuracy; but the country is represented as a wilderness for which "there is a treaty now on foot between the colony and the Six Nations, by which it is expected that all this tract of country, containing 9,000,000 or 10,000,000 of acres, lying between the Ohio River and the Konhaway will be added to Great Britain. It is here laid down from the best information that could be obtained."

All the rivers of Eastern Virginia are beautifully and accurately traced, from their remote risings in the mountains through all their turnings and windings to the bay.

There being but few towns in Virginia at that time, the plantations of distinguished gentlemen are all laid down.

Tracing the north side of James river from "Point Comfort," we come to Hampton, Newport News, Roscow, Blunt Point, Burrell's Bay, Burrell's, Jamestown, Green Spring, Row, Kennon, Weeke, Westover, Taylor's Ferry, Shirley, Ry. Randolph, Col. Cocke's, R. Randolph, Woodson's, Selden's, Cocke's, Verino, Younghusband's, W. Randolph's, Mayo, Richmond, Belvidere, T. M. Randolph, Goods, Woodsons, Goochland Court House, Bolling's Islands, Woodson's, these being the plantations on the north side of James river.

On the south side we find no plantations marked until we come to Cobham in Surry County, then Cocke, Wakefield, City Point; crossing the Appomattox we find Eppes, Bermuda, Hylton, Archer, Woodson, Wathall, Osburn's, Col. Ward's, Warwick, Cary's, Dr. Nevin's, R. Goode's, Falls Plantation opposite Richmond, Rocky Ridge, Tabb's Island, J. Nicholas' opposite the Seven Islands, W. John, Peter Salley at the junction of North and Fluvanna rivers, as the James is called.

The Rappahannock river has all the plantations legibly marked. Beginning on the north side, we find in Lancaster County, Carter, Crossman, Fairwather's, Burger's, Ball, Griffin, Tarpley, Hornby, Bowler's, Tomlin, Sabine Hall, Fauntleroy, Tayloe, Weeks', Leeds, Doraphon, Falmouth, Germanna at the junction of the Rapidan river and Ground Fork. At the bottom of the map is found the "concise account," as follows:

"In the colony of Virginia are 131,000 tithables—55,958 of which number are white men, and the residue consists of negro men and women. It will, I suppose, be reckoned a very moderate computation, to allow three children for every pair of negro tithables; if so, the number of negro slaves will amount to 187,606; and as none but white men are listed as tithables, we must suppose that there are 50,863 women, the proportion between the sexes being commonly stated as 11 to 10; and allowing three children to every woman, there will be 152,589 children. Consequently, the number of inhabitants, white and black, in Virginia, will amount to 447,008—a number greatly exceeding any of the colonies in America. As to the value of this great number of slaves, we can only make a probable computation, founded on

principles well known, and admitted in the colony. A negro man or woman between 16 and 40 years of age is believed to be worth fifty pounds (though three or four years ago they went at double that price), reckoning then the above number of negroes tithable but at 40 pounds each, they will amount to 3,001,680 pounds Virginia currency, and as to the residue, valuing them at but 30 pounds each, they will amount to 3,376,800 pounds, and all of them to 6,378,570 pounds. As to the trade of the colony, its staple is tobacco, and though it does not yield much to the planter, notwithstanding that between 50,000 and 60,000 hogsheads are *communibus annis* exported to Great Britain, yet as 17,000 tons of shipping are employed and many thousand British inhabitants supported thereby, it is very valuable to the subjects, and may also be said to be a jewel to the crown, as so large a sum arises out of the duties. The country indeed is very capable of improvement, and some attempts have been made to raise hemp, though not considerable—the soil, however, is very proper for such production. As to the drink used in the colony, it is generally cider, every planter having an orchard, and they make from 1,000 to 5,000 or 6,000 gallons, annually, in proportion according to their rank and fortune. As to the soil it is very different in different parts; that which lies upon the rivers and their branches, is generally a black deep soil and produces the largest tobacco and all other plants, and, as the country abounds in large navigable rivers, a great proportion of the land is of this kind, the produce of which is very easily brought to market; but the land that lies distant from the rivers is generally of a middling quality, yet produces maize or Indian corn sufficient for the supply of the inhabitants, who chiefly use bread made from the grain; and the meanest and hilly lands are very proper for the peach tree, every planter having an orchard of those trees, the brandy made from that fruit being excellent, and indeed might be made in sufficient quantities for the supply of the people, was there not so much rum imported from the Sugar Islands. As to the manufactories of Virginia, they consist chiefly of cotton, for very little woollen and linen cloth is made in the Province, there being but few sheep; and as little land is spared from tobacco and grain, few of the inhabitants understand the management of flax. Most of the men as well

as women of the lower classes, wear cotton cloth, both in the summer and winter, and it has been computed that there has been manufactured, for one or two years past, of this kind of cloth, to the amount of 250,000 pounds annually. Although this necessarily lessens the importation of Foreign goods, it is not wholly of choice, the people being obliged to it, as the balance of trade, has, for many years, been against them, the colony being much indebted to Great Britain, even in the opinion of good judges, to the amount of 1,500,000 pounds.

In regard to the stocks of horses, cattle, and hogs, they are very considerable, especially the first, there being a great number of the best English breed now among us. And, as to plate and household furniture, this colony exceeds all the others upon the continent, so that, upon the whole, it is much the richest as well as of the greatest importance to Great Britain, and, therefore, well deserves its encouragement and protection."

Pownall, in his Topographical description of North America, says of Henry's map: "A map engraved by Jefferys and called 'A new and accurate map of Virginia, by John Henry,' was published in 1770. I was in hopes to have derived information from this, but upon examination of it, it appears to me to be a very inaccurate compilation; defective in topography; and not very attentive even to geography; the draughtsman or the engraver has totally omitted the South Branch of Potômack River: nor is that curious and interesting piece of information, the communication between the waters of Virginia and the waters of the Ohio, which was known when this was published, marked in it."

1775.

A map of the American indian nations, adjoining to the Mississippi West and East Florida, Georgia, S. & N. Carolina, Virginia, &c. Jno. Lodge sculp.

(*In Adair* (James) The history of the American indians 4° *London, for E. & C. Dilley,* 1775.)

1775.

A map of the most inhabited part of Virginia, (etc.) Drawn by Joshua Fry & Peter Jefferson in 1775. Printed for Robt. Sayer & Thos. Jefferys, London.

(*In Jefferys* (Thomas) & others. The American atlas. fol. *London. R. Sayer & J. Bennett,* 1775, No. 21-22.

Same map as the edition of 1751.

1776.

A new and accurate Chart of the Bay of Chesapeak as far as the navigable parts of the Rivers Patowmack, Patapsco and Northeast. Drawn from several draughts . . . chiefly those of A. Smith, etc. (Plan of Herring Bay in Maryland), 4 sh. *London,* 1776. Title from British Museum Catalogue of Maps, 1885.

A French edition was published in 1778, and it is also found in "Norman's American Pilot, 1798," and "North American Pilot, 1800."

1776.

The seat of war in the middle british colonies.—A general map of the middle british colonies, in America. Containing Virginia, Maryland, the Delaware counties, (etc.) Improved from several surveys made after the late war, and corrected from governor Pownall's late map 1776. *London for R. Sayer & J. Bennett,* 15 Oct. 1776.

(*In Sayer* (Robert) *and Bennett* (John) The american military pocket atlas. 8° *London, for R. Sayer & J. Bennett,* (1776) No. 4.)

1777.

Virginie, Maryland en 2 feuilles par Fry et Jefferson. Traduit, corrigé, augmenté. *Paris, Le Rouge,* 1777.

(*In Lerouge* (Georges Louis) Atlas Amériquain Septentrional. fol. *Paris. le Rouge,* 1778- (1792?) No. 16.)

The map of 1751, with some additional information.

1778.

An exact map of New Jersey, Pensylvania, New York, Maryland, & Virginia.

(*In Russell* (William). The history of America. 4° *London,* 1778, v. 2, facing p. 267.)

1778.

Carte réduite des côtes orientales de l'Amérique Septentrionale, contenant partie du Nouveau Jersey, la Pensylvanie, le

Mary-land, la Virginie, la Caroline Septentrionale, la Caroline Méridionale et la Georgie. (etc.) Dressée au dépôt général des cartes, plans et journax de la marine. Par ordre de M. de Sartine, 1778.

(*In Bellin* (Jacques Nicolas) Hydrographie françoise: fol. (*Paris*, 1737-1778). v. 2.)

1778.

A new map of the western parts of Virginia, Pennsylvania, Maryland, and North Carolina; comprehending the river Ohio and all the rivers, which fall into it; part of the river Mississippi, the whole of the Illinois river, lake Erie; part of the lakes Huron, Michigan, &c. and all the country bordering on these lakes and rivers. By Thos. Hutchins. Engrav'd by T. Cheevers. 35x43. *London, T. Hutchins*, 1778.

There is a descriptive text to the above by the same author, published in 1778, entitled: "A topographical description of Virginia, Pennsylvania, Maryland, and North Carolina."

1778.

Carte de la baie de Chesapeake et de la partie navigable des rivières James, York, Patowmack, Patuxen, Patapsco, North-East, Choptank et Pokomack. Redigée pour le service des vaissaux du roi, par ordre de M. de Sartine d'après des plans anglois et particulièrement ceux d'Antoine Smith, 1778.

See English edition, 1776, and note to the title.

1778.

Churchman's Map, 1778.

To the American Philosophical Society This Map of the Peninsula Between Delaware & Chesapeak Bays with the said Bays and Shores adjacent drawn from the most accurate Surveys is inscribed by John Churchman.

This interesting map was published without place or date. I find the following account of the author in George Johnston's History of Cecil County, Md., 1881, page 526:

"John Churchman, the philosopher, born 1753, lived unmarried, was an eminent surveyor and geometrician; he executed

a map of the peninsula between the bays of Delaware and Chesapeake in 1778; was the author of a magnetic atlas in 1790, and other works of a similar character, which brought him into prominent notice among learned men in Europe and this country, with whom he maintained an extensive correspondence. He twice visited Europe, where he received much attention and was honored with an election as a member of several learned societies. He died at sea in 1805, on his last return voyage from St. Petersburg."

Also in "Appleton's Cyclopædia of American Biography": "John Churchman, author, b. in Maryland; d. at sea, 24 July, 1805. He belonged to the Society of Friends and was noted for his investigations into the causes of the variation of the magnetic needle. In addition to several philosophical treatises, he also published a variation-chart of the globe, magnetic atlas, and explanation (Philadelphia, 1790; London, 1794). He was a member of the Imperial Academy, Russia, and was presented with a set of its transactions. He died on the passage home from Europe."

A sketch of his life may also be found in Futhey and Cope's History of Chester County, Penn., 1881, p. 495-496.

1779.

A new and accurate map of the province of Virginia, in North America.

(*In Universal* (The) magazine. 8° *London, J. Hinton,* 1779. v. 65. dec. 1779. facing p. 281.)

1780.

A new and accurate map of Virginia and part of Maryland, and Pennsylvania. Jno. Lodge sculp. *London, J. Bew,* 31 dec. 1780.

(*In Political* (The) magazine 8° *London, for J. Bew,* 1780, v. 1. dec. 1780, p. 787).

1780-1781.

The marches of lord Cornwallis in the southern provinces, now states of North America; comprehending the two Carolinas, with Virginia and Maryland, and the Delaware counties. By William Faden. *London, W. Faden,* feb. 3, 1787.

(*In Tarleton* (Banastre). A history of the campaign of 1780 and 1781 in the southern provinces of North America 4°. *London, for T. Cadell*, 1787.)

1781.

Carte de la partie de la Virginie ou l'armée combinée de France et des Etats-Unis de l'Amérique a fait prisonnière l'armée Anglaise commandée par lord Cornwallis, le 19 Octobre 1781, avec le plan de l'attaque d'York-town et de Glocester, levée et dessinée sur les lieux par ordre des officiers généraux de l'armée francaise et americaine. *A Paris, chez Esnauts et Rapilly*, (1783).

1781.

A drawn plan of the Peninsula of Chesopeak Bay, compiled from actual surveys by John Hills, assistant Engineer, 1781. 3 sheets.

Title from British Museum Catalogue of maps, 1829.

1781.

A map of the seat of war in the southern part of Virginia, North Carolina, and northern part of South Carolina. By Thos. Kitchin, Jr. 10½x13. R. Baldwin, 1781.

(*In London* (The) magazine. 8° *London, for R. Baldwin*, (1781) v. 50. May 1781. p. 291).

1781.

Partie occidentale de la Virginie, Pensylvanie, Maryland, et Caroline Sept'le la rivière d'Ohio et toutes celles qui s'y jettent partie de la rivière Mississipi, tout le cours de la rivière des Illinois, le lac Erie, partie des lacs Huron et Michigan & Toutes les countrées qui bordent ces lacs et rivières. Par Hutchins, capitaine anglais. 19x23. *Paris, le Rouge*, 1781.

English edition published 1778.

1781.

Plan de l'attaque des Villes de Yorck et Gloucester. *Paris*, 1781. Title from Harvard University Catalogue.

1781.

Plan d'York en Virginie, avec les attaques et les campemens de l'armée combinée de France et d'Amérique.

(In Soulés (François). Histoire des troubles de l'Amérique anglaise. 8° *Paris, Buisson,* 1787. v. 4).

Another map in the same volume, without title, showing the route across the Potomac River and Chesapeake Bay.

1781.

Plan der Belagerung von York-Town in Virginia. D. F. Sotzmann delineavit. (*Hamburg.*)

Title from Harvard University Catalogue.

1781.

A plan of the entrance of Chesapeak bay, with James and York rivers; wherein are shewn the respective positions (in the beginning of October). 1°. Of the british army commanded by lord Cornwallis, at Gloucester and York in Virginia; 2°. of the American and french forces under Gen. Washington; 3°. and of the fleet under count de Grasse. By an officer (*anon.*) *London, W. Faden,* Nov. 20, 1781.

1781.

Plan of the investment and attack of York in Virginia. Engraved by Francis Shallus. Published by C. P. Wayne, Philad'a.

(*In Marshall* (John). The life of George Washington. Maps and subscribers' names. 4° *Philadelphia, C. P. Wayne,* 1807).

1781.

Plan of the investment of York & Gloucester by the allied armies in Sept. & Oct. 1781.

(*In Ramsay* (David). The history of the revolution of South Carolina. 8° *Trenton, I. Collins,* 1785. v. 2. facing p. 326.)

1781.

A plan of the investment of York and Gloucester, Virginia. Tanner scu.

(*In Smith* (Charles, *of N. Y.*) The Monthly repository. 8°. *New York,* (1796, v. 1. facing p. 185).

1781.

Plan of the siege of York Town in Virginia.

(In Stedman (C.) The history of the origin, progress and termination of the american war. 4° *London,* 1794. v. 2. facing p. 412.)

1781.

Plan of the siege of York Town in Virginia. *London,* March 1, 1787.

(*In Tarleton* (Banastre). A history of the campaigns of 1780 and 1781, in the southern provinces of North America. 4°. *London, for T. Cadell,* 1787, facing p. 394).

1781.

A plan of York and Gloucester showing the British and Americans works in 1781. By Captain Edward Fage, Royal Artillery. *London,* 1782.

1781.

A plan of York Town and Gloucester, in the province of Virginia, shewing the works constructed for the defense of the posts of the british army, under the command of earl Cornwallis, together with the attacks and operations of the american and french forces, commanded by Gen. Washington and count Rochambeau to whom the said posts were surrendered on the 17 Oct. 1781. From an actual survey in the possession of Jno. Hills. *London, for W. Faden, Oct.* 7, 1785.

1781.

Plan of York Town in Virginia and adjacent country. Exhibiting the operations of the american, french and english armies during the siege of that place in Oct. 1781. Surveyed from the 22nd to the 28th Octr. Drawn by Jn. F. Renault, with a crow-pen and presented to the marquis de La Fayette. Engraved by B. Tanner. (*anon.*) 19x30. (*Philadelphia,* 1825.)

A handsomely engraved copy of Major Sebastian Bauman's map without name of author.

1781.

Position of the english and french fleets immediately previous to the action on the 5 Sept. 1781.

(*In Stedman* (C.) The history of the origin, progress and termination of the american war. 4. *London,* 1794. v. 2. facing p. 400).

1781.

Sketch of the skirmish at Petersburg, between the royal army and the american army, April 25, 1781. Copied from a plan of Lt. Spencers. By I. Hills. *London, W. Faden,* 1784.

(*In Simcoe* (J. C.) A journal of the operations of the queen's rangers. 4°. *Exeter,* (1787) p. 138).

1781.

That part of Virginia which was the seat of action.

(In Gordon (William, d. d.) This history of the rise, progress, and establishment of the independence of the United States. 8° *London,* 1788. v. 4. plate 8. p. 116).

1781.

To his excellency gen. Washington, commander in chief of the armies of the United States of America, this plan of the investment of York and Gloucester has been surveyed and laid down, and is most humbly dedicated by his excellency's obedient and very humble servant Sebast'n Bauman, major of the New York, or 2d reg't of artillery. This plan was taken between the 22nd & 28th of Oct. 1781. R. Scot sculp. Philad. 1782. 19x25½.

A facsimile of this plan is found in "The Magazine of American History," Jan., 1881., vol. 6, p. 56. Another copy was previously noticed.

1781.

York Town and Gloucester as besieged by the allied army. T. Conder sculpt. London.

(In Gordon (William, *d. d.*) The history of the rise, progress, and establishment of the independence of the United States. 8° *London,* 1788. v. 4, pl. 9, p. 196).

1782.

Carte de la Virginie, du Maryland et de l'état de Delaware.

(In Hilliard d'Auberteuil (Michel René). Essais historiques et politiques sur les anglo-americains. Gravures et cartes. 4°. Bruxelles, 1782, pl. 5).

1782.

Différents camps de l'armée de Yorktown à Boston. (*anon.*) *n. p.* 1782.

1787.

Carte générale des états de Virginie, Maryland, Delaware, Pensilvanie, (etc.) d'après la carte amériquaine de Louis Evans et la carte anglaise de Thomas Jefferys. Gravé par P. F. Tardieu. 19x25½ inches.

(*In Crèvecoeur* (J. Hector Saint John de) Lettres d'un cultivateur américain. 8. *Paris, Cuchet,* 1787, v. 2. front.)

1787.

A map of the country between Albemarle sound, and lake Erie, comprehending the whole of Virginia, Maryland, Delaware and Pensylvania, with parts of several other of the United States of America.

Engraved for the Notes on Virginia. The country on the eastern side of the Alleganey Mountains, is taken from Fry and Jefferson's Map of Virginia and Scull's Map of Pennsylvania, which were constructed chiefly on actual survey; that on the western side of the Allegany is taken from Hutchins, who went over the principal water courses, with a compass and log-line, correcting his work by observations of latitude: additions have been made where they could be made on sure ground.

Engraved by S. J. Neele, London. Publish'd as the act directs July 13th, 1787 by John Stockdale, London.

(*In Jefferson* (Thomas) Notes on the state of Virginia. 8° *London, for J. Stockdale,* 1787.)

1787.

Marches of Lord Cornwallis in the Southern Provinces, comprehending the Two Carolinas, with Virginia and Maryland and the Delaware counties; by Wm. Faden. *London,* 1787.

Title from Harvard University Catalogue.

1792.

A map of the states of Virginia, North Carolina, South Carolina and Georgia; comprehending the Spanish Provinces of East

and West Florida: exhibiting the boundaries as fixed by the late treaty of Peace between the United States and the Spanish Dominions. Compiled from late surveys & Observations by Joseph Purcell. W. Harrison Sen'r & Jun'r sc. Publish'd by John Stockdale Jan'y 25th, 1792.

(*In Morse* (Jedidiah) The american geography. A new ed. 4°. *London, for J. Stockdale*, 1794, facing page 475.)

1794.

A new and accurate chart of the bay of Chesapeake, with the shoals, channels, islands, entrances, soundings and sailing-marks, as far as the navigable part of the rivers Patowmack, Petapsco and North-east. Drawn from several draughts made by the most experienced navigators, chiefly from those of Anthony Smith, pilot of St. Mary's; and compared with the modern surveys of Virginia and Maryland. 2 sheets. *London, Laurie & Whittle* 12 May 1794.

(In North American pilot, 2nd part. A new ed. fol. *London, R. Laurie & J. Whittle*, 1800. No. 11-12.)

The original engraved map is described under title of 1778.

1794.

The state of Virginia from the best authorities, by Samuel Lewis. 1794. 14x20 inches.

(*In Carey* (Matthew). Carey's american atlas. fol. *Philadelphia, M. Carey*, 1795. No. 13.)

1794.

A new and accurate chart of the bay of Chesapeak including Delaware Bay. With all the Shoals, Channels, Islands, Entrances, Soundings, & Sailing marks as far as the Navigable Part of the rivers Potowmack, Patapsco & N. East. Drawn from several Draughts made by the most Experienced Navigators chiefly from those of Anthony Smith Pilot of St. Mary's and compared with the latest surveys of Virginia and Maryland. Boston, Printed & Sold by W. Norman.

(*In Norman* (William). The american pilot. fol. *Boston, W. Norman*, 1798).

Has a printed certificate signed Osgood Carleton, on title page dated "Boston, Sept. 10, 1794." This map differs somewhat from the one in "North American pilot."

1794.

A new chart of the coast of North America from New York to Cape Hattaras including the bays of Delaware and Chesapeak with the coasts of New Jersey, Maryland, Virginia and parts of the coast of North Carolina. By captain (N) Holland. *London, Laurie & Whittle,* 12 May, 1794.

(In North American pilot. 2nd part. A new ed. fol. *London, R. Laurie & J. Whittle,* 1800. No. 9).

1794.

The state of Virginia from the best authorities, by Samuel Lewis. 1794. Smither sculp't. Engraved for Carey's american edition of Guthrie's Geography improved.

(*In Jefferson* (Thomas). Notes on the state of Virginia. 3d. Amer. ed. 8° *New York,* 1801.).

1795.

Virginia.

(*In Scott* (Joseph) The United States gazetteer. 16° *Philadelphia,* 1795).

1795.

Map of the southern states, comprehending Maryland, Virginia, Kentucky, territory s'th of the Ohio, (etc.) By J. Russell. London, published Jan. 10, 1795 by H. D. Symonds.

(In Russell (J.) An american atlas. fol. *London, H. D. Symonds,* 1795. No. 7).

1796.

The state of Virginia from the best authorities 1796. Published by John Reed. N. York. B. Tanner sculp't.

(*In Winterbotham* (William). American atlas. fol. *New York, J. Reid,* 1796. No. 14).

1799.

Map of the Head of Chesapeake Bay and the Susquehanna River, with a plan of the town of Havre de Grace, by C. P. Hauducoeur, 1799.

1804.

Virginia. S. Lewis del. Tanner sc.

(*In Arrowsmith* (Aaron) and *Lewis* (Samuel). A new and elegant general atlas. 4° *Philadelphia* (etc.) *J. Conrad & Co.* 1804. No. 47).

1805.

Map of Virginia, formed from actual surveys, and the most accurate observations; with a view of Richmond, &c. by James Madison, engraved by Fred. Bossler. (1805).

Title from Harvard University Catalogue of maps.

1805.

Virginia. W. Baker sculp.

Scale 70 miles to one inch.

(In Carey (Matthew) Carey's american pocket atlas. 8° *Philadelphia, M. Carey*, 1805, p. 86.)

1806.

Carte de la Virginie, du Maryland et de l'état de Delaware. (1806).

Title from Dufossé's Americana. 10e série. No. 7-12.

1816.

A chart exhibiting the hydrographical remarks and surveys made in the year 1816; in the Southern part of the Chesapeak Bay. By order and under the direction of the Honorable John Rodgers, Stephen Decatur and David Porter, comprising the Board of commissioners in the Navy Department of the United States, by David P. Adams. 2 sheets. Manuscript in U. S. coast survey office.

1816.

York River, Virginia. Surveyed by order of Commissioners of the Navy. By Capt. A. Sinclair, U. S. Navy, 1816. Scale 2 inches to a mile. Copied in manuscript at U. S. coast survey office

1818.

A map of Virginia. Formed from actual survey, and the latest as well as the most accurate observations, by James Madi-

son, late president of Wm. & Mary College. With extensive additions & corrections to the year 1818. Copy Right secured. Richmond, published 4th March 1807. By the Proprietors. To the General Assembly of Virginia this map is Respectfully Inscribed, by their Fellow Citizens James Madison, William Prentis, William Davis, Proprietors. Drawn by Wm. Davis. Scale of miles 69.2 to a degree. 48x70 inches.

Contains a map of Ohio and a plan of Richmond.

1820.

Virginia, Maryland and Delaware. By H. S. Tanner. Engraved and published by H. S. Tanner.

(*In Tanner* (Henry S.) A new american atlas. fol. *Philadelphia, H. S. Tanner,* 1823, No. 15.

Copyright, dec. 20, 1820.

1822.

Virginia. Engrav'd by Young & Delleker.

(*In Carey* (H. C.) and *Lea* (I.). A complete historical, chronological, and geographical american atlas. fol. *Philadelphia, H. C. Carey & I. Lea,* 1822. No. 22.)

No. 21 contains a map of the District of Columbia.

1823.

Virginia, Maryland and Delaware. By H. S. Tanner. [*In* TANNER (Henry S.) A new american atlas. fol. *Philadelphia, H. S. Tanner,* 1823.]

Entered according to act of congress, dec. 20, 1820.

Henry S. Tanner, in the preface to his "A new American atlas, 1823," says: "Notwithstanding the elevated rank which the state of Virginia maintains in the American union, her importance in a political and agricultural point of view, and the intelligence and learning which distinguish many of her citizens, the geography of the great state is suffered to remain far behind that of most of her sister states."

With the exception of Madison's map, which is rendered nearly obsolete by the innumerable improvements and changes which a busy and enterprising population are perpetually effect-

ing, there is no engraved map of Virginia in existence, but such as are founded upon and include all the errors of it, that of Bishop Madison.

1824.

Map of Virginia and Maryland. Constructed from the latest authorities. 1824. Drawn by D. H. Vance. Engraved by J. H. Young. Published by A. Finley. Philad'a 1824.

(*In Finley* (Anthony). A new american atlas. fol. *Philadelphia, A. Finley*, 1826. No. 7). Contains a small "Plan of Washington city & Georgetown."

1825.

Carte géographique, statistique et historique de la Virginie. Buchon. *Paris*, (1825.)

Title from Dufossé's Americana. 10e série. No. 7-12.

1826.

A map of the state of Virginia. Constructed in conformity to law, from the late surveys, authorized by the legislature. By Herman Böye. (*Philadelphia, H. S. Tanner*, 1826.)

1832.

Chart of Chesapeake and Delaware Bays, by Fielding Lucas, Jr., 1832.

1833.

A new map of Virginia with its canals, roads & distances from place to place, along the stage & steam boat routes. By H. S. Tanner. Tanner's universal atlas. Published by H. S. Tanner. Engraved by W. Brose, Philadelphia.

(*In Tanner* (Henry S.) A new universal atlas. fol. *Philadelphia, author*, 1836, No. 13).

Map copyrighted in 1833.

1833.

A new map of Virginia. With its canals, roads & distances from place to place, along the stage & steam boat routes. By H. S. Tanner. Engraved by W. Brose, Phila. Published by H. S. Tanner, Philadelphia.

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1833.

Virginia, Maryland and Delaware. Exhibiting the route of the James river & Kanawha improvement. Engraved & Published by H. S. Tanner, Philadelphia. Entered according to Act of Congress, in the year 1833.

1835.

Engraved for the gazetteer of the state of Virginia, exhibiting its internal improvements, roads, distances, &c. by J. H. Young. Philadelphia, published by S. Augustus Mitchell, 1835.

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The map contains one of the District of Columbia.

1836.

Map of the mining district of Virginia. By W. A. Jackson. 23x24 inches. Published by W. A. Jackson, Fredericksburg, and H. S. Tanner, Philadelphia.

Stafford, Culpeper, Fauquier, Spotsylvania, Orange, Louisa, Goochland and Buckingham counties.

1836.

Small map of Maryland and Virginia, by Fielding Lucas, Jr., 1836.

1837.

Map of the counties of Monongalia, Tyler, Harrison, Wood, Lewis, Randolph, the north western portion of Virginia.

(*In Sketch* of western Virginia. (*anon.*) 16° *London, E. Bull,* 1837).

1841.

A new map of Virginia, with its canals, roads, and distances. By H. S. Tanner. *Philadelphia,* Carey & Hart.

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1848.

A map of the internal improvements of Virginia. Prepared by C. Crozet, under a resolution of the general assembly, adopted March 15, 1848. *Philadelphia, engraved at P. S. Duval's lith. establt.* (1848).

1852.

Map of Jefferson county, Virginia, by S. Howell Brown. From actual survey with the farm limits. col. 38x52 fold. 8°. [*Staunton, Va.*, 1852.]

1853.

Map of Loudoun county, Virginia. From actual surveys by Gardley Taylor. 35x48.
Philadelphia, T. Reynolds & R. P. Smith [1853].

1858.

Map of Virginia. Containing the counties, principal towns, railroads, rivers, and all other internal improvements. Lithographed and published by Ritchie & Dunnavant. Prepared by L. Bucholtz. col. fold 25x36. *Richmond, Ritchie & Dunnavant*, 1858.

186-.

Middle Virginia and North Carolina. Drawn by H. Lindenkohl. 22x19. (*Washington*, 186-.)
[United States, *Treasury department, Coast survey*.]

1861.

Army map of the seat of war in Virginia, showing the battle fields, fortifications etc. on and near the Potomac river. Drawn by J. G. Bruff. col. 25x27. *New York, J. Disturnell.* [1861.]

1861.

Map showing the war operations in Virginia and Maryland. col. 25x36. *Boston, J. H. Bufford.* [1861.]

1861.

Colton's new topographical map of the eastern portion of the state of North Carolina with part of Virginia and South Carolina. 28x40. fold. 18°. *New York, J. H. Colton.* 1861.

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Map of the seat of war, showing the battles of July 18th, 21st, and October 21st, 1861. $21\frac{1}{2}$x25. *Washington, V. P. Corbett.* [1861.]

1861.

The key to east Virginia, showing the exact relative positions of Fortress Monroe, Rip Raps, Newport News, Sewalls Point, Norfolk, Gosport navy yard, and expressing the soundings of every part of Hampton Roads and Elizabeth river. Compiled from government survey and drawn by M. K. Couzens. col. $18\frac{1}{4}$x$23\frac{1}{4}$. *New York, W. Schans.* [1861.]

1861.

Map of part of Virginia, Maryland and Delaware, from the best authorities. Compiled from official sources, by Charles Heyne. 26x38. *New York, E. & G. W. Blunt.* 1861.

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Map of the seat of war in Virginia. Drawn by Wm. Perris. 20x$24\frac{1}{2}$. *New York, lith. by C. W. Corss, printed by Lang & Laing.* [1861.]

1861.

New county map of Virginia. Published by O. N. Snow & Co. fold. 20x26. *New York, O. N. Snow & Co.* [1861.]

1861.

Lloyd's official map of the state of Virginia. From actual surveys by order of the executive, 1828 and 1829. Corrected and revised by J. T. Lloyd to 1861. col. fold. 34x47. *New York, J. T. Lloyd.* [1861.]

1861.

Eastern Virginia and part of Maryland. col. 20x25. *New York, Schönberg & Co.* 1861.

1861.

Sketch of the seat of war in Alexandria and Fairfax counties. By *V. P. Corbett.* 11x15. *Washington.* 1861.

1862.

Colton's new topographical map of the states of Virginia, Maryland and Delaware, showing also eastern Tennessee and parts of other adjoining States, all the fortifications, military stations, etc. Compiled from the latest and most authentic sources on a scale of 12 miles to the inch. Published by J. H. Colton. col. fold. 31x44. *New York, J. H. Colton.* 1862.

1862.

Coast of North Carolina and Virginia. Compiled at the coast survey office, February, 1862. Drawn by A. Lindenkohl. 48x34. [*Washington.* 1862.]

[*United States, Treasury Department, Coast Survey.*]

1862.

Lloyd's new war map of Virginia. Published by H. H. Lloyd & Co. col. fold. 16x27. *New York, H. H. Lloyd & Co.* 1862.

1862.

Map of eastern Virginia. Compiled by W. L. Nicholson. col. 24x18. Washington, Coast Survey Office, 1862.

[*United States, Treasury Department, Coast Survey.*]

1862.

Map of part of southeastern Virginia. Compiled at the U. S. Coast Survey Office. Drawn by A. Lindenkohl. 21x27 (*n. p.* 1862).

[*United States, Treasury Department, Coast Survey.*]

1862.

Map of western Virginia. Compiled from the best authorities, and printed at the Coast Survey Office. Compiled by W. L. Nicholson. col. 22x19. Washington, Coast Survey Office. 1862.

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War telegram marking map. 22x33¼. *Boston, L. Prang & Co.* 1862.

1862.

"Surveys for military defences." Map of northeastern Virginia and vicinity of Washington. Compiled at Topographical Engineers' Office at Division Headquarters of Gen. Irvin McDowell, Arlington, January 1st, 1862. From published and manuscript maps, corrected by recent surveys and reconnaissances. 49x66. fold. 8°. *New York, engraved on stone by J. S. Schedler. United States, War Department, Corps of Engineers.* 1862.

1863.

County map of Virginia and West Virginia, Drawn and engraved by W. H. Gamble. $11\frac{1}{2}$x14.
[*Philadelphia, S. A. Mitchell.* 1863.]

1863.

Map of the State of Virginia. Compiled from the best authorities at the Coast Survey Office, July, 1863. Compiled by W. S. Nicholson. col. 22x34. [*Washington.* 1863.]
[*United States, Treasury Department, Coast Survey.*]

1863.

Military map of southeastern Virginia. Compiled at the U. S. Coast Survey Office. fold 32x29. Drawn by A. Lindenkohl. [*Washington, H. Lindenkohl & C. G. Krebs, lith.* 1863.]
[*United States, Treasury Department, Coast Survey.*]

1863.

New map of the seat of war in Virginia and Maryland. Drawn by J. G. Bruff. col. 26x28. fold. 18°.
New York, J. Disturnell. 1863.

1864.

Johnson's Virginia, Delaware, Maryland and West Virginia. col. 17x23.
New York, Johnson & Ward. 1864.

1864.

Military map of southeastern Virginia. Drawn by A. Lindenkohl. col. 18x32. *Washington, H. Lindenkohl & C. G. Krebs, lith.* 1864.

[*United States, Treasury Department, Coast Survey.*]

1864.

Military topographical map of eastern Virginia. Showing the routes taken by the several army corps and the battles fought in the present campaign of 1864 under Lieut.-General U. S. Grant. Compiled and drawn by Charles Sholl. fold. 35x22. *New York, R. Shauncy.* [1864.]

1864.

Schönberg's Virginia campaign map. col. 13½x20. *New York, Schönberg & Co.* 1864.

1864.

Map of the vicinity of Richmond and part of the peninsula. From surveys made under the direction of A. H. Campbell, capt. P. E. C. S. A. in charge of topographl. Dept. D. N. V. 1864. Fac-simile reproduction made from the original Confederate war map owned by T. Sewell Ball, publisher, Pikesville, Baltimore co. Maryland. A. B. Graham, photo. lith. Wash. D. C. 20x22½ inches.

1865.

Extract of military map of northeast Virginia, showing forts and roads. Engineer Bureau, War Department, 1865. 39th Cong., 1st sess. Report of the chief engineer, No. 1. 16½x23½. *Philadelphia, Bowen & Co.* [1865.]

[*United States, War Department, Corps of Engineers.*]

1865.

Region embraced in the operations of the armies against Richmond and Petersburg. 39th Cong., 1st sess. Report of the chief engineer. No. 12. 24x32. *Philadelphia, Bowen & Co., lith.* [1865.]

[*United States, War Department, Corps of Engineers.*]

1866.

Schönberg's map of Virginia east and west. col. fold. 11x15. (*New York, Schönberg & Co.*). [1866.]

1868.

Virginia military institute map of Virginia. Compiled chiefly from C. L. Ludwig's map, and from other more recent data. To accompany the preliminary report of the physical survey of Virginia, by M. F. Maury. December, 1868. 14½x35.

[In *Maury* (M. F.) Physical Survey of Virginia. 8°. *Richmond,* 1868, front.]

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Boughman, Thomas & Co.'s map of the peninsula, embracing Delaware and the Eastern Shores of Maryland and Virginia. Compiled from the U. S. coast surveys and other actual surveys, by D. G. Beers. col. 40x26.

Wilmington, Boughman, Thomas & Co. 1868.

1871.

Map of the States of Virginia, West Virginia and Maryland, exhibiting the counties, cities, etc. col. 15x23.

Cincinnati, E. Mendenhall. 1871.

1871.

Map of Virginia, constructed on the rectangular tangential projection, by J. H. Waddell. Prepared under the instructions of M. F. Maury. 16½x31. [In *Maury* (M. F.) Physical survey of Virginia. Richmond, 1878, front.]

1871.

Preliminary map of Lunenburg county, Va. Prepared under the direction of the Board of Survey of Washington and Lee University, by Jed. Hotchkiss. fold. 20x22.

Staunton, Va. 1871.

1874.

Map of Virginia. By Jed. Hotchkiss, No. 1. fold. 10x19.

Staunton, Va. 1874.

1874.

Map of Virginia. By Jed. Hotchkiss, No. 2. col. fold. 10x19.

Staunton, Va. 1874.

1874.

Map of Virginia. By Jed. Hotchkiss. Staunton. The geology by Prof. William B. Rogers. col. fold. $9\frac{1}{2}$x22.

Richmond, lith. by A. Hoen & Co. [1874.]

1877.

Gray's new topographical map of Virginia and West Virginia. By Frank A. Gray. col. 16x24.

Philadelphia, O. W. Gray & Son. [1877.]

1877.

Map of Rockingham county, Virginia, with parts of adjacent counties, showing the location of the coal and iron lands and projected railroad of the Royal Land Company of Virginia. By Jed. Hotchkiss. col. 17x20.

Staunton, Va. 1877.

1879.

Gray's new map of Virginia. By Frank A. Gray. Prepared for the Department of Agriculture, etc. $15\frac{1}{2}$x27.

[*In* VIRGINIA, *Department of Agriculture*—Hand-book of Virginia. 4th ed. 8°. *Richmond.* 1885.]

1879.

Jacob's 1878 official map of Prince Edward county, Virginia. Prepared by order of the Board of Supervisors. By H. Jacob. 23x30.

New York, Am. Photo-Litho. Co. [1879.]

[*Prince Edward county, Virginia, Board of Supervisors.*]

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Colton (G. W. & C. B.) & Co. Colton's new topographical map of the States of Virginia, West Virginia, Maryland and Delaware and portions of adjoining States. col. 30x43. *New York, G. W. & C. B. Colton & Co.* [1881.]

1881.

Preliminary post route map of the States of Virginia and West Virginia, together with Maryland and Delaware, Pennsylvania, Ohio, Kentucky, Tennessee and North Carolina. By W. L. Nicholson. Drawn by C. H. Poole. 4 sheets fold. fol. *Washington.* 1881.

[*United States, Post Office Department, Topographers' Office.*]

1881.

Map of the Virginia, Kentucky and Ohio Railroad, connecting the railroads of Virginia with the railroads of Kentucky from the Mississippi Valley to the Atlantic Ocean. 30x43. *New York, G. W. & C. B. Colton & Co.* 1881.

1882.

The associated railways of Virginia and the Carolinas and their connections, forming the Richmond and Danville Air Line, the Atlantic Coast Line, the Virginia Midland Line, the Seaboard Air Line. col. fold. 15x21. *Chicago, Rand, McNally & Co.* 1882.

1892.

Rand, McNally & Co.'s indexed county and railroad map and shippers' guide of Virginia. 79 pp. 1 fold. map. 16°. *Chicago* and *New York, Rand, McNally & Co.* [1892.]

1893.

Rand, McNally & Co.'s indexed county and railroad pocket map and shippers' guide of Virginia. 81 pp. 16° *Chicago* and *New York, Rand, McNally & Co.* 1893.

INDEX OF AUTHORS AND DATES.

(The dates refer to chronological order in body of the work.)

SMITHSONIAN INSTITUTION.

WASHINGTON CITY, *January, 1898.*

This work (No. 1087), "A CATALOGUE OF EARTHQUAKES ON THE PACIFIC COAST, 1769 to 1897," by Edward S. Holden, forms part of Smithsonian Miscellaneous Collections, Volume XXXVII.

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A Catalogue of Earthquakes on the Pacific Coast, 1769 to 1897. By Edward S. Holden. City of Washington, published by the Smithsonian Institution, 1898. 8°. ii, 253 pp., with 5 plates and 5 text figures.

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MAP OF CALIFORNIA AND NEVADA.

SMITHSONIAN MISCELLANEOUS COLLECTIONS

——— 1087 ———

A CATALOGUE OF EARTHQUAKES

ON THE

PACIFIC COAST

1769 TO 1897

BY

EDWARD S. HOLDEN, LL.D.

Member of the National Academy of Sciences

CITY OF WASHINGTON
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CONTENTS.

ILLUSTRATIONS.

INTRODUCTION.

In the year 1887 the Regents of the University of California authorized the printing and distribution of an octavo pamphlet whose title was "List of Recorded Earthquakes in California, Lower California, Oregon and Washington Territory, compiled by . . . Edward S. Holden." This was the first systematic publication of the sort, and it served a useful purpose. The examination of past records naturally led to the consideration of the best manner of making future ones. The object of such records is to bring to light all the general facts as to distribution of earthquake shocks, as to topographic areas, as to time, as to average intensity, etc., and also to enable a study to be made of particular shocks—as to velocity of transit, area of the disturbed region, intensity, etc. In order to study any of these questions with profit it is necessary to have some kind of a measure of the intensity of each earthquake shock. The most satisfactory instruments that I have seen for this purpose are those invented by Professor Ewing, F. R. S. These are devised on sound mechanical principles, and are well constructed by the Cambridge Scientific Company. It was necessary at the Lick Observatory to keep a register of the times of occurrence of all earthquake shocks in order to see if the positions of the astronomical instruments were affected. Accordingly, a set of Professor Ewing's instruments was ordered for the Observatory, and they were delivered in 1887.

The Lick Observatory began its active work in 1888. A part of this work consisted in the registration of earthquake shocks. Reports of shocks felt elsewhere on the Pacific Coast were diligently collected, and the publication of the pamphlet before mentioned brought me into relations with various gentlemen who were kind enough to communicate MS. notes or diaries relating to earthquake phenomena in earlier years.

The present volume reprints the pamphlet of 1887, with many corrections and additions; and it gives a complete account of the earthquake observations at Mount Hamilton during the years 1887 to 1897, together with an abstract of the great amount of information which has been collected regarding Pacific Coast earthquakes in the latter period. All previously printed information has been thoroughly revised before its admission to these pages.

The chief sources drawn upon are—

First—Printed lists of earthquake shocks in the scientific journals; such as the lists of Mallet, Perrey, Rockwood, Fuchs, Trask and others.

Second—Accounts of earthquakes in printed books, magazines and newspapers.

Third—Lists of shocks put at my disposition by various gentlemen, especially a list by Mr. Thos. Tennent, of San Francisco; a list by Prof. H. G. Hanks; and a very extensive collection kindly furnished by Mr. H. H. Bancroft from manuscript records.

Fourth—Verbal accounts from various friends of the Observatory.

Fifth—The earthquake records of the University of California (Berkeley); the Chabot Observatory (Oakland); the University of the Pacific (San José); Mills Seminary (Oakland); the Weather Bureau (Carson, Nevada); and of the Lick Observatory (Mount Hamilton). All these stations are supplied with earthquake instruments.

I have to thank Professor Rockwood, of Princeton University, for putting me in the way of gaining much of the printed information. I have also to express my great obligations to the Board of Directors of the Mechanics' Institute Library, to the Council of the California Academy of Sciences, and to the Librarians of the Mechanics' Institute, Mercantile and Academy of Science libraries in San Francisco, the University of California Library at Berkeley, and of the State Library at Sacramento, for exceptional facilities afforded me in the consultation of books. Mr. W. C. Winlock, late of the Smithsonian Institution, kindly consulted, in the Library of Congress, books which were not available in California. The various sources of information have been thoroughly examined, and the necessary data for a brief reference list, or index, have been extracted and set in order in the catalogue which follows.

The list of books and periodicals consulted is given in the following:

Bibliography of Works Relating to Earthquake Phenomena on the Pacific Coast.

Anderson (C. L.): Dr. Anderson, of Santa Cruz, has consulted the diaries of Mr. Sawin, of Santa Cruz, and of Dr. C. A. Canfield, who lived 15 or 20 miles northwest of San Benito, Monterey County, and has extracted many interesting records of earthquake shocks. (Referred to here as Anderson's MS.)

Annual Statistician, San Francisco [to 1888 inclusive]. 8vo. (A. S.)

Annals of San Francisco, by F. Soulé, etc. New York. 8vo.

Bache (A. D.): Notice of Earthquake Waves, etc. U. S. C. S. Report, 1855, p. 342, and 1862, p. 238.

Bancroft (H. H.): History of the Pacific States. 8vo. (H. H. B.)

———: MS. notes kindly communicated. (B. MS.)

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———: Monthly Bulletin, 1891–96. 8vo.

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Friend (C. W.): Earthquakes in Nevada—in *Reports* of the Nevada State Weather Service for various years, and in private letters. (C. W. F.)

Fuchs (C. W. C.): Statistik der Erdbeben [1865–85]. *Sitzungsber. d. Wiener Akad.* 1885, Bd. 92, Heft 3.

Halley (Wm.): Centennial Book of Alameda County, pp. 257–269. Oakland, 1876. 8vo. Detailed account of the damage done by the shock of 1868, October 21, in Alameda County.

Hanks (H. G.): Professor H. G. Hanks, late State Mineralogist, has been kind enough to put all his manuscript and other material at my disposition. It is here referred to as (H. MS.).

Hittell (T. H.): History of California. San Francisco. 8vo. (T. H. H.)

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Mallet (R.): Catalogue of recorded Earthquakes from 1606 B. C. to A. D. 1850, by Robert Mallet, C. E., M. R. I. A., in the *Report of the British Association*, 1854. (R. M.)

Mendenhall (T. C.): On the Intensity of Earthquakes. *Proc. Amer. Ass. Adv. Sci.*, 1888.

Milne (J.): Earthquakes and other Earth Movements. New York, 1886. 8vo.

Mining and Scientific Press: for the years 1864–72. Weekly newspaper. San Francisco. 4to.

Nature: Vols. 1–54 (1869–96). London. 8vo.

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Perrey (A.): Note sur les tremblements de terre. *Bull. de l'Acad. R. de Belgique*, 1845; tome 13, p. 234. 1849; tome 17, p. 216. 1850; tome 18, p. 291. 1851; tome 19, part 1, p. 353. 1852; tome 20, p. 39. 1853; tome 21, p. 457. 1854; tome 22, part 2, p. 526. 1855; tome 23, p. 23.

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Perrey (A.): Sur les tremblements de terre aux Etats-Unis et au Canada. *Ann. de la Soc. d'Emulation des Vosges*, tome 7, 2e cahier, 1850. [I have not seen this work, as it is not in any library in California and not in the Library of Congress.]

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Rockwood (C. G.): Notes on American Earthquakes, by Professor C. G. Rockwood, Jr., Ph. D., Princeton, N. J. (C. G. R.) From the *American Journal of Science*, 3rd series, vols. 1872–87. (*See* Whitney.)

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Tennent (T.): List of Earthquakes in San Francisco, 1851–87 and 1888–93, from manuscripts kindly furnished by Mr. Tennent. Many of these are also printed in the *Annual Statistician*, q. v. (T. T.) Mr. Tennent's accurate observations extend over a period of forty-two years.

Trask (J. B.): A Register of Earthquakes in California from 1800 to 1863. [Reprinted from *Proc. Cal. Acad. Sci.*, S. F.] San Francisco, 1864. 8vo.

Trask (J. B.): Earthquakes in California from 1812 to 1855 [*Proceedings of the California Academy of Natural Sciences*], by Dr. John B. Trask. Vol. I (1854–57). Vol. III (1863–67). Vol. IV, part 1. (J. B. T.)

Trask (J. B.): Direction and velocity of the earthquake in California of the 8th and 9th January, 1857. *Amer. Jour. Sci.*, Jan. 1858, vol. 25, p. 146.

Veatch (J. A.): In *Mining and Scientific Press*, 1868, March 31, has an article on Earthquakes in San Francisco, and specially on their direction.

Washington (United States Light House Board): *Annual Reports.*

——: MS. Reports from lighthouse keepers, kindly communicated by the Secretary of the Board.

Washington (United States Geological Survey): MS. reports kindly communicated by the Director of the Survey.

Washington (United States Signal Service); Monthly Weather Review. (U. S. W. R.)

——: (United States Weather Bureau); *ibid.* (U. S. W. R.)

Whitney (J. D.): On the Earthquake of 1872, March 26. There is a résumé of Professor Whitney's article (*Overland Monthly*, vol. 9), by Professor Rockwood, in *Amer. Jour. Sci.*, vol. VI, 1872.

From the above sources of information the following catalogue has been derived.

For each shock there is given, when possible, *first*, the year, month and day; *second*, the hour, minute and second. The time is here given exactly as it is found in the original. Usually it is expressed in local civil time. In Dr. Trask's list it is intended to be astronomical time (0h. is noon, and 12h. midnight), though there are probably several errors in this datum. For the later lists it is usually Pacific standard (railway) time.* In Mr. Tennent's observations it is San Francisco local mean time to and including March 25, 1884, and after that date Pacific standard time. Professor Rockwood's plan to avoid the danger of confounding A. M. and P. M. dates, is to adopt the system of numbering the hours in the civil day from 0 to 24 (0h. is midnight, 12h. is noon). I have not brought the hours to a single uniform standard, in order to avoid introducing mistakes in copying, and especially because very few of the times are really accurate. Mr. Tennent's list is without doubt quite the best in this regard. Since January 1, 1887, all the stations of the Southern Pacific Railroad, and since August, 1887, those of the Atlantic and Pacific Railway, receive a noon signal (Pacific standard time) from the Lick Observatory or from the

* *i. e.* Greenwich time *minus* 8 hours.

U. S. Naval Observatory at Mare Island, and since this date, therefore, there is more likelihood that the times in this catalogue are accurate. *Third,* the place or places where the shock has been felt. Here the abbreviation "S. F." stands for San Francisco. When necessary the name of the county is added for convenience. *Fourth,* the intensity of the shock, expressed either in common language or in terms of some arbitrary scale. Professor Rockwood, in indicating the intensity, has used the adjectives: 1, very light; 2, light; 3, moderate; 4, strong; 5, severe; 6, destructive; but has added a Roman numeral to indicate the intensity, according to the Rossi-Forel scale, adopted by Swiss and Italian seismologists. In Professor Rockwood's papers, very light is II or III; light, IV; moderate, V or VI; strong, VI or VII; severe, VIII; destructive, IX or X.

Fifth—A brief reference to the source of information, so that in nearly all cases the original record can be consulted, if desired. Exceptionally heavy shocks, such as those of 1865, 1868 and 1872, are treated with much more fullness than the lighter ones.

I strongly recommend the use of the Rossi-Forel scale, on account of the definiteness of the classification and because of the comparative regularity of the gradations. In order to make it better known in California, I reprint it here:

THE ROSSI-FOREL SCALE.*

I.

Microseismic shock—recorded by a single seismograph, or by seismographs of the same model, but not putting seismographs of different patterns in motion; reported by experienced observers only.

*First proposed by Rossi in *Archives des Sci. Phys. et Nat.*, IV, p. 371 (1880), and quite independently by Forel, *ibid.*, VI, p. 461. After comparing hundreds of published accounts of California earthquakes, I have found that the words here printed in *italics* (which form no part of the Rossi-Forel scale as proposed by its authors) are frequently employed by California observers. They are here printed for convenience. When any one is describing the effect of a shock he should employ the numerals I, II, III, etc., of the Rossi-Forel scale. When, on the other hand, one is reading an account of a California earthquake and seeking to assign the proper R.-F. numeral, it will be found that the words here set down in italics are of service.

II.

Shock recorded by several seismographs of different patterns; reported by a small number of persons who are at rest. *A very light shock.*

III.

Shock reported by a number of persons at rest; duration or direction noted. *A shock; a light shock.*

IV.

Shock reported by persons in motion; shaking of movable objects, doors and windows, cracking of ceilings. *Moderate;* sometimes *strong; sharp; light.*

V.

Shock felt generally by every one; furniture shaken, some bells rung, *some clocks stop. Smart; strong; heavy; severe; sharp; quite violent; some sleepers waked.*

VI.

General awakening of sleepers; general ringing of bells; swinging of chandeliers; stopping of clocks; visible swaying of trees; some persons run out of buildings; *window-glass broken. Severe; very severe; violent.*

VII.

Overturning of loose objects; fall of plaster; striking of church bells; general fright, without damage to buildings; *nausea. Violent; very violent.*

VIII.

Fall of chimneys; cracks in the walls of buildings.

IX.

Partial or total destruction of some buildings.

X.

Great disasters; overturning of rocks; fissures in the surface of the earth; mountain slides.

The Lick Observatory will be glad to receive corrections or additions to the list of shocks catalogued.

The information can be very conveniently given by answering the following questions, which are copied from a circular prepared by Captain C. E. Dutton, U. S. A., for the U. S. Geological Survey:

"1. Post Office address; town, county, and State.

2. Place and date of observation.

3. Name and address of the observer, if other than the writer.

4. Position and occupation of observer at time of the shock, and character of the ground. State whether observer was in the house or out of doors; what kind of a house (wooden or stone); up stairs or down; what doing at the time; whether the ground at surface was rock, clay, sand, or loam; about how far down to solid rock.

NOTE.—If the shock was not felt in your neighborhood, although noticed at places not very far distant, do not fail to answer these first four questions, as negative reports are of great interest in defining the limits of the disturbed area, etc. State also the nearest point to your station where the shock was felt.

5. State as exactly as possible the *time of commencement* and the *duration* of each shock.

The exact time of the beginning of a shock (to the nearest second), one of the most important of all observations, is difficult to get correctly, because of the great velocity with which the wave travels (about three miles a second), and because the watch or clock must be immediately compared with a clock known to be keeping standard time. If several hours have elapsed before the comparison is made, another comparison should be made an hour later, in order to find whether your timepiece is gaining or losing, and how much. Unless it is stated that this has been done, the observation cannot be regarded as a good one till confirmed by other reports. Telegraph operators, railroad officials, watchmakers, etc., have especially good opportunities for answering this question correctly, and their coöperation is most earnestly solicited.

6. Give any facts that you can as to sounds accompanying shocks and as to the direction in which the earthquake wave seemed to travel.

If any sound, other than the mere creaking of woodwork, etc., accompanied the shock, state as fully and accurately as possible whether it preceded, accompanied, or followed the shock, and what interval there was, if any; also what the sound was like. Describe

the character of the shock, whether a tremor or an undulatory motion, etc., and whether you yourself or others had any clear impression as to the direction in which it was moving, the facts upon which this impression was based, and whether people agreed as to the direction.

7. Which number on the Rossi-Forel scale of earthquake intensity best expresses the intensity of the shock in your vicinity?

8. Give, also, any further particulars of interest, whether they are from observation or from hearsay.

If a chandelier was noticed to swing, describe it, and state the direction and amount of swing. If pictures swung, state direction of wall, and whether pictures on other walls at right angles to the first were also put in motion. If doors were closed or opened by the shock, state the direction of the wall in which they are set. If a clock was stopped, give the exact time it indicated (and anything known, as how fast or how slow it was), its position, the direction in which it was facing, and the length of the pendulum. If any changes occurred in the ground, such as depressions or elevations of the surface, fissures, emissions of sand or water, describe them fully. Mention any unusual condition of the atmosphere; any strange effects on animals (it is often said that they will feel the first tremors of a shock before people notice it at all); character of damage to buildings, general direction in which walls, chimneys, etc., were overthrown. Springs, wells, and rivers are often noticeably affected even by slight shocks, and any information in regard to such changes will be valuable.

9. Name of the writer.

Note.—In replying to these questions, they need not be repeated; but the answers should be *numbered* to correspond to the questions."

The lists which follow give recorded earthquakes in their chronological order. It is desirable to arrange the statistics in various ways—by years, by months, by seasons, etc.—in order to exhibit any periodicity there may possibly be in the phenomena. It is a favorite hypothesis that shocks follow in cycles; and this is true of some regions, apparently.

The tables A, B, C were prepared for the first edition of this book, and are here reprinted without change. The addition of the data since 1887 would not alter the conclusions to be derived from them.

Tables of the Number of Earthquakes which are Recorded in each Month of each of the Years 1850-1887, in California, Washington and Oregon.

In the three following tables I have counted the days in each month of each year on which shocks (supposed to be different) have occurred. For example, a shock felt at a given hour at San Francisco and at Oakland is counted as one; but shocks at different places, as San Diego and San Francisco, on the same day, are counted separately when they are not *known* to be parts of the same phenomenon.

Table (A) of the Number of Earthquakes which are Recorded in California, Oregon, etc., in the Years 1850–1887.

Year.	Total.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1850..........	8	1	1	1	....	1	1	....	2	1	....	...	....
1851..........	15	....	....	1	1	3	1	....	....	....	....	4	5
1852..........	6	....	....	....	1	....	....	....	....	....	....	3	2
1853..........	22	4	2	1	2	....	1	1	....	1	3	4	3
1854..........	22	2	1	2	3	4	1	2	1	1	3	1	1
1855..........	14	2	1	....	1	....	2	2	2	....	2	....	2
1856..........	25	5	1	3	1	3	....	....	2	5	2	1	2
1857..........	31	6	1	3	1	3	1	1	2	2	2	6	3
1858..........	10	....	2	....	....	....	....	....	2	5	...	1	....
1859..........	19	1	....	1	1	....	....	....	5	4	1	2	4
1860..........	20	2	1	3	5	2	1	....	....	3	....	2	1
1861..........	11	2	....	2	2	....	1	2	....	....	1	....	1
1862..........	19	1	....	1	....	5	8	1	....	1	1	....	1
1863..........	17	4	2	....	....	....	2	4	1	....	1	....	3
1864..........	22	....	1	4	....	2	2	4	2	3	3	....	1
1865..........	42	3	2	6	4	1	1	....	2	3	16	2	2
1866..........	24	1	3	4	....	3	3	1	2	1	....	1	5
1867..........	6	1	1	....	1	....	....	....	....	1	....	1	1
1868..........	54	....	....	1	....	6	2	1	3	26	10	3	2
1869..........	31	4	2	1	2	2	4	2	....	4	5	....	5
1870..........	19	2	3	2	6	3	....	....	2	1	....	....	....
1871..........	19	....	1	2	1	1	2	5	2	2	2	....	1
1872..........	41	....	3	7	15	2	1	....	1	2	5	2	3
1873..........	15	....	2	1	3	1	1	1	1	....	2	2	1
1874..........	10	2	....	2	....	1	1	....	2	....	....	....	2
1875..........	17	1	1	....	....	....	3	....	1	....	1	5	5
1876..........	7	1	....	1	....	1	....	....	1	....	2	....	1
1877..........	16	2	1	....	....	2	1	2	3	3	1	1	....
1878..........	17	....	1	2	1	2	1	2	....	3	2	1	2
1879..........	8	....	2	....	....	2	....	....	2	....	1	....	1
1880..........	26	1	....	2	3	1	1	....	2	1	....	5	10
1881..........	23	7	3	1	2	....	1	2	1	1	2	3	....
1882..........	26	1	1	5	2	1	1	3	4	1	5	1	1
1883..........	28	2	1	3	1	....	....	2	2	4	7	1	5
1884..........	27	4	....	2	5	....	3	1	3	3	3	3	....
1885..........	39	5	5	2	7	1	3	4	....	2	3	1	6
1886..........	12	1	....	....	....	3	1	2	...	1	2	1	1
Sums......	768	68	45	66	71	56	51	45	53	85	88	57	83

As many of the earthquakes of California are very local phenomena, which depend upon local causes for their production, we cannot expect to obtain very definite laws from a table like this which covers the whole of such a vast territory. Moreover, the facilities for gathering information in the thinly settled portions of the State were imperfect in the earlier years, and even now shocks are not carefully recorded at more than two or three places in the State. For these and other reasons this table can only give approximate results. It does not include every single earthquake set down in the catalogue, since it was compiled before the list was entirely finished. It, however, contains nearly all. It is sufficiently full for its purpose, which is simply to show the relative frequency of shocks in the various months. This is for:

1850–1887.	January	68	
	February	45	182, near Vernal Equinox (1850–1887). (Rainy Season.)
	March	66	
	April	71	
	May	56	152, near Summer Solstice (1850–1887). (Dry Season.)
	June	51	
	July	45	
	August	53	226, near Autumnal Equinox (1850–1887). (Dry Season.)
	September	85	
	October	88	
	November	57	208, near Winter Solstice (1850–1887). (Rainy Season.)
	December	83	
	January	68	

Rainy season, 390; dry season, 378. *Thus for California, Oregon and Washington at large, shocks are about equally probable in the wet and in the dry season.* Table A includes the data derived from observations at San Francisco. If we form a similar table which includes all the data for California, Oregon, etc., *excluding* San Francisco, the result will be, for:

1850–1887.	January	43	
	February	23	119, near Vernal Equinox. (Rainy Season.)
	March	40	
	April	56	
	May	39	105, near Summer Solstice. (Dry Season.)
	June	34	
	July	32	
	August	42	159, near Autumnal Equinox. (Dry Season.)
	September	64	
	October	53	
	November	27	131, near Winter Solstice. (Rainy Season.)
	December	61	
	January	43	

Rainy season, 250; dry season, 264. (See the last column of Table B.)

TABLE (B) OF THE NUMBER OF EARTHQUAKES WHICH HAVE BEEN RECORDED IN EACH MONTH OF EACH OF THE YEARS 1850–1887 IN SAN FRANCISCO.

YEAR.	Total.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in California except S. F.
1850...	5	1	1	....	....	1	1	....	....	1	....	....	....	3
1851...	10	....	....	....	....	2	1	....	....	....	....	4	3	5
1852...	1	....	....	....	....	....	....	....	....	....	....	1	....	5
1853...	5	1	....	1	....	....	....	....	....	....	....	2	1	17
1854...	8	1	1	1	2	1	....	....	....	....	2	....	....	14
1855...	3	....	....	....	....	....	....	....	1	....	1	....	1	11
1856...	10	4	1	2	....	1	....	....	1	....	1	....	....	15
1857...	17	1	1	2	....	....	....	1	....	2	2	5	3	14
1858...	7	....	1	....	....	....	....	....	2	3	....	1	....	3
1859...	8	....	....	....	....	....	....	....	1	2	1	2	2	11
1860...	9	1	1	....	2	1	....	....	....	2	....	1	1	11
1861...	4	....	....	1	1	....	1	1	....	....	....	....	....	7
1862...	2	....	....	....	....	....	....	....	....	1	....	....	1	17
1863...	8	1	....	....	....	....	1	2	1	....	....	....	3	9
1864...	16	....	1	3	....	2	2	3	....	3	1	....	1	6
1865...	23	1	2	4	3	1	....	....	1	....	9	1	1	19
1866...	9	1	2	1	....	1	1	1	....	....	....	....	1	15
1867...	2	1	....	....	....	....	....	....	....	1	....	....	....	4
1868...	14	....	....	1	....	1	....	1	....	....	7	3	1	40
1869...	10	2	2	....	1	2	3	....	....	....	....	....	....	21
1870...	8	1	3	4	....	....	....	....	....	....	....	....	....	11
1871...	2	....	1	....	1	....	....	....	....	....	....	....	....	17
1872...	5	....	....	1	....	....	....	....	1	....	3	....	....	36
1873...	4	....	2	....	1	....	....	....	....	....	....	1	....	11
1874...	6	2	....	1	....	1	1	....	....	....	....	....	1	4
1875...	8	....	1	....	....	....	3	....	....	....	1	3	....	9
1876...	2	1	....	....	....	....	....	....	....	....	1	....	....	5
1877...	2	....	....	....	....	1	....	....	1	....	....	....	....	14
1878...	4	....	1	....	....	....	....	....	....	2	....	1	....	13
1879...	1	....	1	....	....	....	....	....	....	....	....	....	....	7
1880...	4	....	....	....	1	1	1	....	....	....	....	1	....	22
1881...	5	1	....	....	....	....	....	....	....	1	1	2	....	18
1882...	9	....	....	1	1	....	1	2	1	3	....	....	....	17
1883...	6	1	....	1	1	....	....	....	....	....	3	....	....	22
1884...	5	1	....	2	1	....	....	1	....	....	....	....	....	22
1885...	5	2	....	....	....	....	....	....	....	....	1	1	1	34
1886...	7	1	....	....	....	1	1	1	....	....	1	1	1	5
Sums.	254	25	22	26	15	17	17	13	11	21	35	30	22	514

The number of shocks recorded at San Francisco in the separate months (1850-1887) are:

	Month	Shocks	Group
1850–1887.	January	25	
	February	22	63, near Vernal Equinox. (Rainy Season.)
	March	26	
	April	15	
	May	17	47, near Summer Solstice. (Dry Season.)
	June	17	
	July	13	
	August	11	67, near Autumnal Equinox. (Dry Season.)
	September	21	
	October	35	
	November	30	77, near Winter Solstice. (Rainy Season.)
	December	22	
	January	25	

Rainy season, 140; dry season, 114. *Shocks in San Francisco are considerably more frequent in the rainy season than in the dry, contrary to the rule for the State at large.* The average number of shocks per month is $\frac{21}{37}$. *January, March, October and November have decidedly more shocks than the average; April, July and August have decidedly fewer than the average.*

A comparison of the monthly totals for San Francisco and for California (excluding San Francisco) seems to indicate that the causes of most San Francisco earthquakes are local and not general in their nature. The records from which this table has been derived are so full that considerable weight must be allowed to the conclusions drawn from it.

As San José is situated near to Mount Hamilton, where accurate earthquake observations will be carried on for many years to come, it is desirable to examine the earthquake records for San José and Santa Clara as carefully as may be.

TABLE (C) OF THE NUMBER OF EARTHQUAKES WHICH ARE RECORDED IN EACH MONTH OF THE YEARS 1850–1887, IN SAN JOSÉ AND SANTA CLARA.

YEAR.	Total.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Shocks in S. F.
1850	3			1		1				1				5
1851	0													10
1852	0													1
1853	2											2		5
1854	0													8
1855	0													3
1856	1		1											10
1857	4	1			1						1	1		17
1858	3									2		1		7
1859	4				1				2				1	8
1860	0													9
1861	0													4
1862	0													2
1863	3							2					1	8
1864	5		1	1				1		1			1	16
1865	4										4			23
1866	9		1									1		9
1867	0													2
1868	1										1			14
1869	4		1	1	1		1							10
1870	1		1											8
1871	1		1											2
1872	1			1										5
1873	3		1						1				1	4
1874	1								1					6
1875	2										1	1		8
1876	2	1									1			2
1877	0													2
1878	1										1			4
1879	0													1
1880	2					1						1		4
1881	1											1		5
1882	0													9
1883	0													6
1884	1			1										5
1885	2							1					1	5
1886	0													7
Sums.	61	2	7	5	3	2	1	4	4	4	9	8	5	254

The data for San José and Santa Clara are far less full than for San Francisco. Probably an equal number of shocks has occurred at each place, but the records of San Francisco (which are well kept) show about four times as many shocks as are shown by the San José records (which have not been carefully kept).

The distribution of shocks in the various months is as follows, for:

1850–1887.	January	2	
	February	7	15, near the Vernal Equinox. (Rainy Season.)
	March	5	
	April	3	
	May	2	7, near the Summer Solstice. (Dry Season.)
	June	1	
	July	4	
	August	4	17, near the Autumnal Equinox. (Dry Season.)
	September	4	
	October	9	
	November	8	15, near the Winter Solstice. (Rainy Season.)
	December	5	
	January	2	

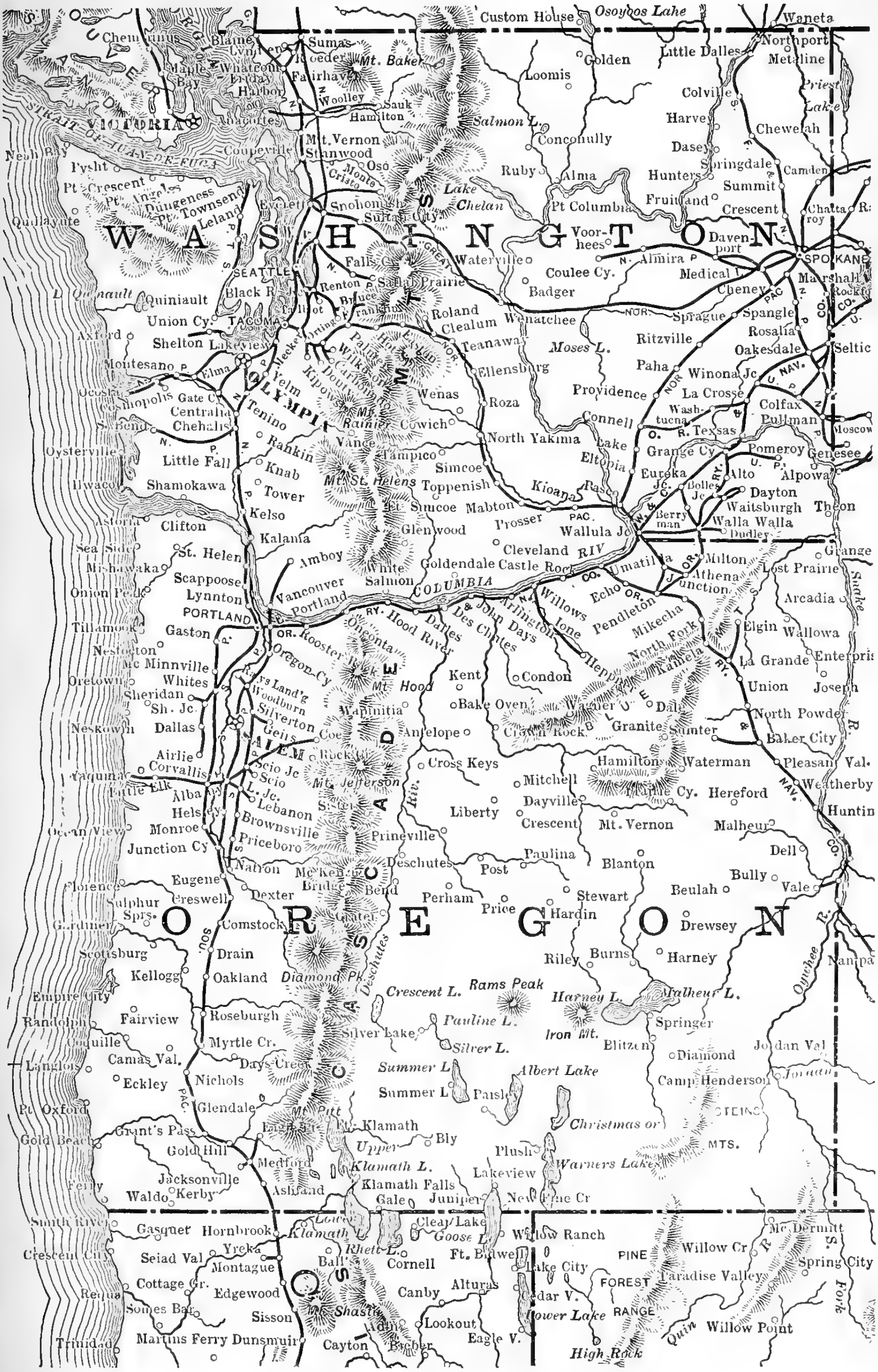
Rainy season, 30; dry season, 24. *Like San Francisco, and unlike California at large, San José seems to have more shocks in the rainy season.*

The average number of shocks per month is 4½ divided by 37.

February, October and November have decidedly more shocks than the average; January, May and June have decidedly fewer than the average. July and August have (unlike San Francisco) the average number of shocks. If the data are sufficient to draw any conclusion from (which very probably they are not), this would show that the shocks at San José are local, and that they are, in general, not dependent upon the same cause as those of San Francisco.

Similar tables can be formed for the places where the catalogue shows shocks to be relatively frequent, as Humboldt, Los Angeles, Oakland, San Diego, Monterey, Santa Cruz, Sacramento, etc., and, so far as the data are sufficient, the same result will be indicated, namely, that the light earthquakes common in California are usually rather local than general and widespread phenomena. A curious example of this is the exemption of Santa Barbara from shocks in the years 1860-1872. Before 1860 and after 1872 Santa Barbara was subject to shocks, precisely as other places in the same region, while between these years no shock is recorded. There is no reason to believe that the records were not equally well kept during the whole period.

The immediate and practical conclusion to be drawn from the above tables is that in any future study of California earthquakes we ought to select special regions for examination, as the Valleys of



MAP OF WASHINGTON AND OREGON.

Santa Clara, Napa, San Joaquin, Salinas, Amador, Clear Lake, Pitt River, etc., rather than to attempt wider ranges. It may thus be possible to fix the origin of the local shocks, and finally to be reasonably certain of its permanency. It also appears to me that the data seem to indicate that the greater number of California earthquakes have been the result of faulting in the underlying strata rather than due to volcanic causes directly.

Earthquake Shocks felt at Sea off Cape Mendocino, etc.

The list of recorded earthquakes contains notices of several shocks reported in this general neighborhood, as follows: 1868, May 18; 1870, December 4; 1873, November 22; 1876, August 16; 1877, October 26; 1884, June 12; 1884, November 4; 1895, March 1, October 24.

A relief map of the ocean bed near Cape Mendocino, made by Professor George Davidson and Mr. Winston, shows the coast to be very "steep-to"; and it further shows two submarine mountains in the neighborhood. The slipping of the earth at the junction of the steep submarine cliff with the (comparatively) flat ocean floor, may very well be the cause of some of these disturbances. It is also possible, on the other hand, that they are connected with the two submarine elevations mentioned. More observations are needed to decide this question. It is a little remarkable that we have reports of shocks felt at sea in this vicinity and none, or few, at other points along the coast. (See Plate V, page 31.)

Self-Registering Seismometers.

The Lick Observatory possesses a set of earthquake recorders made from the designs of Professor J. A. Ewing of Cambridge. The following description of them is extracted from Professor Ewing's note in *Nature* of August 12, 1886. A similar set is installed in the Students' Observatory of the University of California at Berkeley. (See Plates III and IV, pages 18 and 20.)

(1) A Horizontal Seismograph, with clock and driving plate. The clock is started by an electric contact at the beginning of the earthquake, and the two rectangular components of the horizontal motion (N and S, and E and W) are registered side by side on a rotating plate.

(2) A Vertical Motion Seismograph, to register the vertical movement of the surface of the earth on the same plate.

(3) A Duplex Pendulum Seismograph, to give independent records of the horizontal motion on a fixed plate, the pencil being free to move in all azimuths.

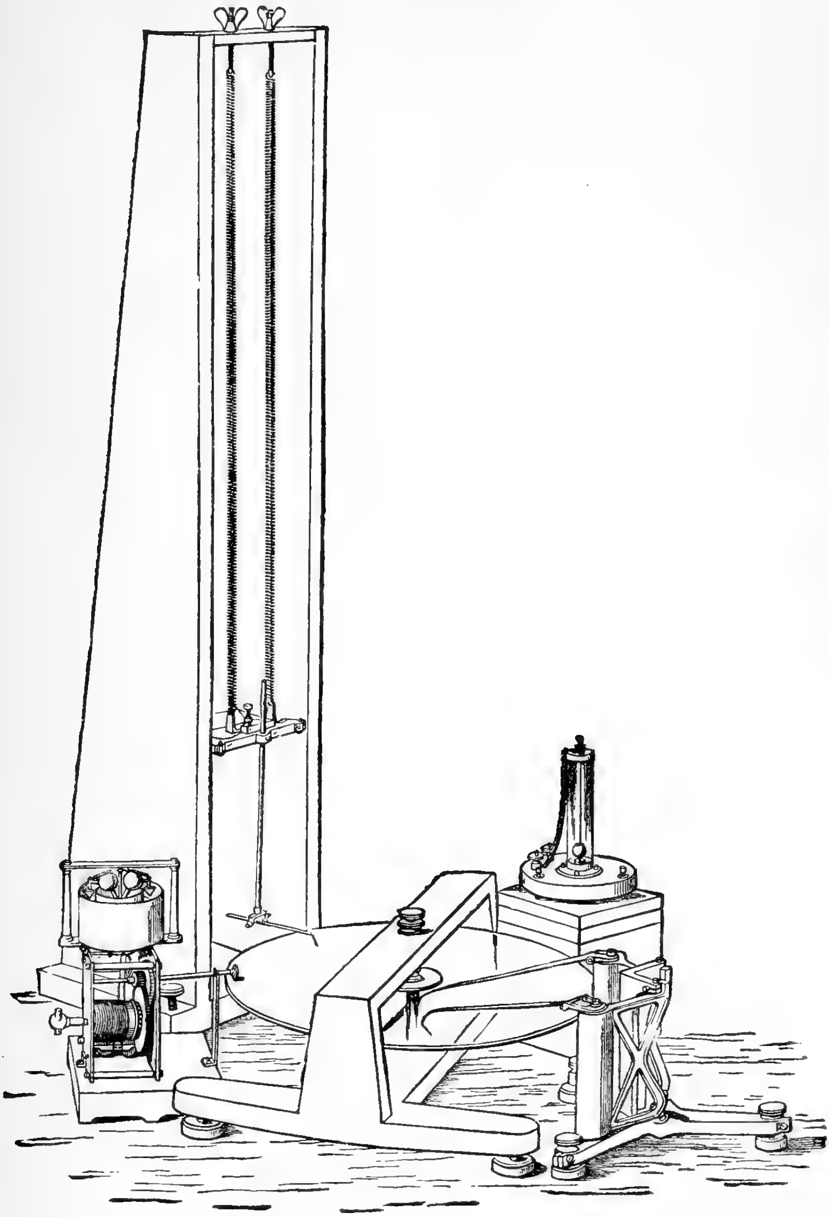
(4) A Chronograph attachment, which is set in motion at the beginning of a shock, and records the time of its occurrence. It also marks the clock seconds upon the revolving plate of No. 1.

"In the design of these seismographs the object has been kept in view of making them easily capable of use by observers who have not made seismometry a special study. They are entirely self-recording, and require little attention during the long intervals which must, in most situations, be expected to elapse between one period of activity and the next.

One group of instruments is arranged to give a complete record of every particular of the movement, by resolving it into three rectangular components—one vertical and two horizontal—and registering these by three distinct pointers on a sheet of smoked glass which is made to revolve uniformly by clockwork. A single earthquake always consists of many successive displacements of the ground; hence the record traced by each pointer on the moving plate is a line comprising many undulations, generally very irregular in character. The amplitude, period, and form of each of these are easily measured, and by compounding the three we obtain full information regarding the direction, extent, velocity and rate of acceleration of the movement at any epoch in the disturbance.

This group of instruments is shown in Plate III. In the centre is the plate of smoked glass, which gets its motion through a friction-roller from a clock* furnished with a centrifugal governor, acting by fluid-friction, and balanced so that its speed is not sensibly affected by the shaking of the ground. The clock is started into motion by means of a Palmieri seismoscope, which appears in the figure, behind the plate, on the right. This is a small common pendulum, whose bob carries at the bottom a piece of stiff platinum wire that projects into a recess in a cup of mercury below—the recess being formed by an iron pin standing lower than the surface of the surrounding mercury. On the slightest shaking of the ground, contact with the edge of the mercury takes place, and this closes a circuit which releases an electro-magnetic detent and starts

* At the left-hand side of the cut.



COMPLETE THREE-COMPONENT SEISMOGRAPH, FOR MOTIONS IN ALL DIRECTIONS.

The three pens are steady during a shock, while the glass plate moves to and fro with the earth, and at the same time is made to rotate by the clock (at the left hand in the cut). The steady pens mark the components of the earth's motions on the smoked surface of the revolving plate.

the clock. This occurs during the preliminary tremors which are usually found in advance of the main movements of an earthquake. The same circuit starts another clock* (of the escapement type) which fulfills two functions. It marks time on the revolving plate during a part of the first revolution, and then continues to go as an ordinary clock, so that, by inspecting its dial afterwards, the interval which has elapsed since the occurrence of the earthquake is known, and the date of the shock in hours and minutes is thus determined with as much precision as the phenomenon admits of. This part of the apparatus is omitted from the figure. The two horizontal components of motion are recorded by a pair of horizontal pendulums, set at right angles to each other, but with their indices inclined so that they write side by side on one radius of the plate. The pendulums are supported on a single stand, but with independent adjustments for position and stability. Each has two pivots, consisting of hard steel points, which turn in sapphire centres. At the pivots and at the tracing-points every effort has been made to avoid friction. The indices are of aluminium, and a part of their weight is taken by springs (not shown in the figure), so that their pressure on the plate may be no greater than is necessary to produce a trace on the sooty film. The vertical component of motion is recorded by the instrument which appears behind the clock. A massive bar, free to move vertically about a horizontal axis, is held up by a pair of long spiral springs. Its equilibrium is made nearly neutral by applying the pull of the springs at a suitable distance below the horizontal plane through the axis of support. A bell-crank lever with a jointed index gives a multiplied trace of the apparent vertical oscillations of the bar, which correspond to vertical displacements of the ground. In this instrument, as in the others, sapphire centres are used to minimize friction.

Records inscribed on the plate are preserved by varnishing the plate and using it as a 'negative' to print photographs. The motion, as recorded, is magnified to an extent which experience has shown to be desirable in dealing with disturbances ranging from those which are just recognizable as earthquakes up to those which are to some extent destructive.†

* Not shown in the cut.

† In the Lick Observatory instrument the horizontal components are multiplied 3.3 times and the vertical component is multiplied 1.6 times. The indices are made of stout straws.

Another and distinct instrument is the duplex pendulum seismograph, shown in Plate IV. A massive bob is hung by three parallel wires from the top of a three-cornered box, and is reduced to nearly neutral equilibrium by being coupled by a ball-and-tube joint to the bob of an inverted pendulum below it. The two form a system which can be made as nearly astatic as is desirable, and so furnish a suitable steady-point for the horizontal part of earthquake movement in any azimuth. The motion is magnified* and recorded by a vertical lever geared to the upper bob by a ball-and-tube joint, supported on gimbals from a bracket fixed to the box, and furnished with a jointed index which writes on a fixed plate of smoked glass. Records of the kind which the duplex pendulum gives are of course incomplete in two important particulars: they show nothing of the vertical motion (which, however, is usually a comparatively small part of the whole), and they show nothing of the relation of *time* to displacement throughout the disturbance. But they exhibit very clearly the change of direction which the movements undergo, and the actual direction taken by any pronounced element of the shock."

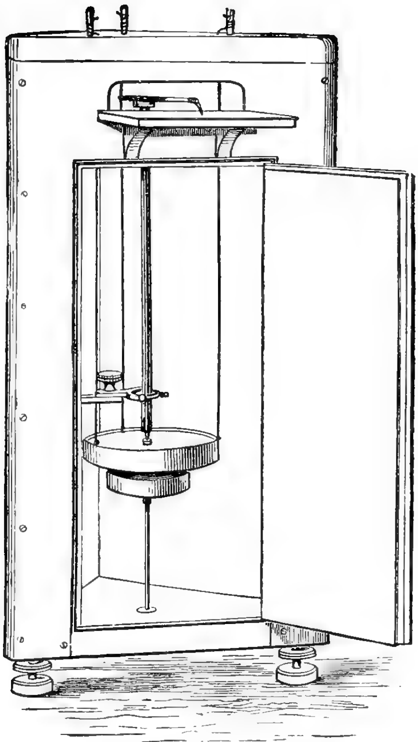
These instruments have been kept in working order at Mount Hamilton since June, 1888.

The larger instrument is somewhat complicated and is not suitable for private establishments, where its care would require too much time. The smaller seems to be what is wanted for a general instrument to record (the horizontal components of) shocks of average intensity.

I have had a copy made of it, with some simplifications and improvements, and such copies can be purchased from Paul Seiler's electrical works, 406 Market Street, San Francisco, for $15.

Such copies have been set up in California at various places, among others at the Cliff House, S. F. (Hon. A. Sutro), Kono Tyee, Lakeport (Miss Floyd), Chabot Observatory, Oakland (Mr. Charles Burckhalter), Students' Observatory, Berkeley (Professor Frank Soulé), Highland Park, East Oakland (Mr. F. G. Blinn), University of the Pacific, San José (the Professor in charge of the Observatory), Stanford University (Professor Branner), Mills Seminary, Oakland (Professor Keep). Other copies have been sent

* In the Lick Observatory instrument the horizontal components are magnified 4 times.



DUPLEX PENDULUM SEISMOGRAPH FOR HORIZONTAL MOTIONS.

During a shock the pen is steady and writes the trace of the horizontal motions of the earth on the moving plate of smoked glass (on the shelf near the top of the instrument-case).

out of the State, for example: to Cleveland, Ohio (Warner and Swasey), Washington, D. C. (U. S. Geological Survey), Carson, Nevada (Professor C. W. Friend), Readville, Mass. (Blue Hill Observatory), *Santiago de Chile (National Observatory), *Mexico (Tacubaya) (National Observatory), *Cordoba, Argentine Republic (National Observatory), *Greenwich, England (Royal Observatory).

It may be useful to print in this place the following brief instructions for setting up the Duplex Seismometer, which were prepared by Dr. Joseph Le Conte and myself in 1887 and sent out with the first instruments:

Use of the Ewing Duplex Seismometer.

"The object of the instrument is to automatically register on a smoked glass plate the horizontal motions of the earth below its base.

"The best way to set up the instrument is to drive a post into the ground about four feet. The top of the post should be sawed off square as near to the ground as convenient, a piece of stout plank spiked to it, and the three leveling-post screws of the instrument placed on this. The screws should be turned until the two pendulums hang freely at equal distances from the frame all around, and until the pointer or index is near the centre of the glass plate. A line marked N—S on this plate should be put in the north and south line (N to the north).† If the instrument cannot be placed at the surface of the ground, it should be placed as near to the surface as possible (since it is desired to register the movements of the ground and not the oscillations of any particular house or part of a house), and it should always be placed on a post firmly set in the ground when this can be done. If this is not practicable, it should be placed in the best position attainable. It is convenient to have the instrument protected by a glass case. The glass plate should be smoked on one side by holding it above the flame of a lamp or candle (burning camphor gives the best film of soot). The instrument is then ready for use.

"When a shock occurs, the base of the machine will be moved and

* Presented to the Observatory by Mateo Clark, Esq., of London.

† A line registered on the plate from the point of beginning towards N (if caused by a shock) means that the earth has itself moved north below the instrument.

the glass plate will move with it. The double pendulum is so constructed as to remain steady, or very nearly so; the pointer over the glass plate remains steady also, and writes the motion of the earth upon the moving plate. The motion of the earth is magnified approximately four times. The line traced on the plate will represent the *direction* of each shock, and the length of the line gives a measure of the *intensity*. In any large earthquake this line will be a looped curve. If the *time of beginning* of the earthquake is also noted by the observer on his watch, and if the watch is compared as soon as possible with the time of the nearest railway station (time is received daily at noon, at all railway stations, from the Lick Observatory), all the data are secured which are necessary for the accurate study of the shock at this one station. If the original glass plate is carefully packed (so as to preserve the film) and sent to the Director of the Lick Observatory, it will be measured at the Observatory, and a blue print of the tracing will be returned to the sender, together with the original glass plate. The memorandum relating to the time of the shock should also be sent, with a statement of exactly how and where the instrument is mounted. As soon as one glass plate is removed, the spare plate furnished with the instrument should be blackened and inserted. The only precautions necessary to be taken in the use of this instrument are to keep it level and to keep a freshly-smoked plate underneath the pointer."

During the years 1888-1897 the large Ewing seismograph of the Lick Observatory has been under the charge of Messrs. Keeler, Hill, A. J. Burnham and Perrine, and certain improvements in its construction have been suggested by experience. Some of these improvements have actually been made. The following memorandum has been prepared at my request.

Improvements in the Ewing Seismographs Suggested by Experience.

BY C. D. PERRINE.

" Our experience with the Ewing seismograph of the Lick Observatory has suggested some slight changes to improve its working. The magnetic release for the driving clock has frequently failed to act, as a heavy current was required to move the armature, which

is heavy, while the leverage of the magnet is short and the releasing arm long. The magnet was removed from its old position and placed much nearer the point of release; the armature and movable lever were made much lighter, and, when tested, they were found to respond to a much lighter current than in the old form.

"The governor of the driving clock is of the conical pendulum type, with paddles attached to the arms, which work in a trough filled with oil. In an instrument where the clock is in operation but a small portion of the time this form of regulation is objectionable. In our instrument the oil was removed and small strips of rubber attached to the paddles so that they would rub against the bottom of the empty oil trough. This has worked satisfactorily, as there is no great accuracy required in the rate of this clock. A small double conical pendulum, such as is now used on chronographs by Warner and Swasey or Saegmüller, adapted to this particular case, would probably be most satisfactory.

"As the beats of the time-clock are registered on the edge of the plate, it would be much more convenient if the clock beat either seconds or half-seconds instead of about 95 times per minute, as at present.

"There was too much friction between the spring-pen used to record the clock beats on the plate, owing to inequalities in the glass plates. Less friction and more uniform beats were secured by hinging the pen so that it had a considerable range vertically.

"The pen for recording the vertical motion has considerable 'creep,' probably owing to changes in the springs due to temperature, but this is not a matter of much importance if the instrument is always started by the shock. A small lever has been attached to the front of the case of the Duplex Seismograph in such a way that the pen can be raised mechanically and held out of the way while the plate is being changed."

March 29, 1897.

Quite a number of reports have been received of late years from the instruments installed in California and Nevada, and these records are of value. It would be of extreme interest if a series of such machines could be distributed around the Santa Clara valley, so as to encircle it on both sides, and so as to be situated on like geological strata. A line of instruments in the valley from Gilroy

to San Francisco, and another line on the east side of the bay, would be required. A few years' observations carefully studied would, I think, bring out results of consequence. The basin of Clear Lake should be studied in the same way, as its shocks appear to be of a special class.

Reported Volcanic Eruptions on the Pacific Coast.

The list of shocks printed in 1887, and those compiled during succeeding years, contained many reported "eruptions" of mountains in the Puget Sound region. For a number of years I made it my business to apply by letter to intelligent observers in that neighborhood to determine whether Mount Baker and other mountains had ever certainly been known to be in eruption. Clouds hanging over the summit, snow blown from the slopes, etc., might, in my own opinion, account for all the reported phenomena. Still it was not possible to be certain either way, and I have left the accounts of such eruptions as they were first printed.

In 1896 Mr. Frederick G. Plummer, C. E., was kind enough to copy from his papers a list of the eruptions of Alaska volcanoes (1690 to date) and of the reported eruptions of the mountains around Puget Sound. This list was printed in the *Publications* of the Astronomical Society of the Pacific and is reprinted here. I have not incorporated this data in the catalogue of earthquakes which follows; it is more convenient in its present shape. Particular attention is called to the introductory paragraphs of Mr. Plummer's valuable list. Reports in the newspaper press on this subject are never decisive. To establish the fact of an eruption of one of the Puget Sound volcanoes it is necessary to have the report of an expert who was on the spot.

Reported Volcanic Eruptions in Alaska, Puget Sound, etc., 1690 to 1896.

BY FREDERICK G. PLUMMER.

Tacoma, Washington, *March* 13, 1896.

"There can be no doubt that many eruptions are reported which might be contradicted if examination were possible. For example, the reports of the eruption and change in the summit of Mount Tacoma from November 21 to December 25, 1894, filled many

columns of the press dispatches, and possibly were intended for that purpose. December 25th was the most perfect day for observation, and, with my 6½-inch refractor, the crater-peak and its surroundings were carefully examined, and no change could be seen. No eruption was noted, other than the usual emission of steam, which varies with the barometer. However, reports came in later from a press party which claimed to have reached the slope of the mountain and witnessed an eruption of smoke. The party was about five miles from the summit, and my telescope, with low power, brought the summit within half a mile. Although this was the clearest and most definite report of eruption, yet it is so flatly contradicted by the continuous telescopic observations and the later examinations of climbers, that it is omitted from the table."

Date of Beginning.		Name of Volcano.	Duration of Eruption.	Phenomena. A=Alaska; O=Oregon; W=Washington.
Year.	Day.			
1690	....	Khaginak ....A.	....	A crater formed.
1700	....	On Amak Island, A.	10 years	Occasionally active.
1741	....	Hiamna.........A.	....	....
1760	....	Adakh..........A.	....	....
1760	....	Goreloi..........A.	....	....
1760	....	Chechitno.......A.	....	....
1760	....	Atka............A.	....	....
1760	....	Koniushi........A.	....	Island rose.
1762	....	Pavloff..........A.	....	....
1763	....	Tanaga..........A.	7 years	....
1763	....	Kanaga ....A.	....	Solfataras.
1768	....	Unalashka ......A.	....	....
1768	....	Medviednikoff ...A.	....	....
1768	....	Walrus..........A.	....	....
1770	....	Amukhta........A.	....	....
1774	....	Four Craters....A.	....	....
1775	....	Calder..........A.	....	....
1775	....	Unimak.........A.	3 years	Flames and smoke.
1776	July	Sitignak ....A.	....	Flames and smoke.
1778	....	Iliamna.........A.	92 years	Occasionally smoke.
1778	....	Shishaldin ......A.	....	....
1784	....	Vsevidoff........A.	....	....
1784	July	Chechitno.......A.	....	....
1786	....	Seguam ....A.	4 years	....
1786	....	Amukhta........A.	5 years	....
1786	....	Kanaga ....A.	....	Flames and smoke.
1786	....	Pavloff..........A.	....	North crater fell in.

Date of Beginning. Year.	Day.	Name of Volcano.	Duration of Eruption.	Phenomena. A=Alaska; O=Oregon; W=Washington.
1790	....	Akutan ....A.	....	....
1790	....	Vsevidoff.........A.	....	....
1790	....	Kanaga ....A.	....	....
1790	....	Semisphnoi......A.	....	....
1790	....	Makushin ....A.	2 years	Occasionally smoke.
1790	....	Shishaldin ......A.	35 years	Occasionally smoke.
1791	June	Tanaga..........A.	....	....
1791	June	Kanaga ....A.	....	....
1792	....	Great Sitkin.....A.	....	....
1792	February ?	Goreloi..........A.	4 months	Flames.
1792	June 1	Semisopochnoi . . A.	....	....
1795	....	Unimak.........A.	....	SW. crater exploded and fell in.
1796	....	Edgecombe......A.	....	....
1796	May	Bogoslov ....A.	....	Terrible eruption of flames
1796	....	Four Craters....A.	4 years	....
1796	....	Amak...........A.	....	....
1802	....	Makushin ....A.	....	Flames and smoke.
1806	....	Bogoslov ....A.	....	Lava flow.
1812	....	Sarycheff ....A.	....	Violent eruption.
1817	April	Yunaska.........A.	....	....
1817	....	Umnak ....A.	....	....
1819	....	Wrangell........A.	....	....
1819	....	Redoubt ....A.	....	....
1820	....	Rogoslov........A.	....	....
1824	....	Shisldin.........A.	....	....
1824	....	Yunaska.........A.	....	....
1825	March 10	Isanotski ....A.	....	....
1826	October 11	Unimak.........A.	....	....
1827	....	Shisldin ....A.	3 years	....
1827	....	Pogrumnoi ......A.	2 years	....
1827	....	Koniushi........A.	....	....
1827	....	Kanaga ....A.	....	....
1828	....	Little Sitkin ....A.	2 years	....
1828	....	Akhun...........A.	2 years	....
1828	....	Akutan ....A.	2 years	....
1828	....	Tanak-Angunakh A.	2 years	....
1828	....	Atka............A.	2 years	....
1828	....	Koniushi........A.	2 years	....
1828	....	Goreloi..........A.	2 years	....
1830	....	Korovin ....A.	....	....
1830	....	Atka............A.	....	....
1830	....	Yunaska.........A.	....	....
1830	....	Umnak..........A.	....	....
1830	November	Unimak ....A.	....	Violent eruption.
1830	....	Veniaminoff.....A.	....	....
1831	....	St. Helens......W.	12 hours	....
1831	....	Hood ....O.	....	....
1832	....	St. Helens......W.	....	....
1838	....	Shishaldin ......A.	....	Flames.

Date of Beginning. Year.	Day.	Name of Volcano.	Duration of Eruption.	Phenomena. A=Alaska; O=Oregon; W=Washington.
1838	....	Four Craters....A.	....	....
1838	....	Makushin.......A.	....	....
1838	....	Akutan.........A.	....	....
1838	....	Veniaminoff.....A.	....	....
1838	....	Pavloff.........A.	....	....
1839	....	St. Elias........A.	....	....
1840	....	Cinder Cone.....A.	....	Cinders.
1841	....	Tacoma........W.	....	....
1841	....	St. Helens......W.	....	....
1842	....	St. Helens......W.	2 months	Smoke and light ashes.
1842	....	Baker..........W.	....	....
1843	November 13	St. Helens......W.	10 days	Flames and light ashes.
1843	November 13	Tacoma........W.	....	....
1843	December ?	St. Helens......W.	85 days	....
1844	....	Korovin........A.	....	....
1844	....	Makushin.......A.	....	....
1846	....	Hood...........O.	....	....
1846	....	St. Helens......W.	....	....
1846	....	Baker..........W.	....	....
1847	....	Baker..........W.	....	....
1852	....	St. Helens......W.	....	....
1853	January	Baker..........W.	....	Slight lava flow.
1854	February	St. Helens......W.	70 days	....
1854	August	Hood...........O.	....	....
1854	Summer	Baker..........W.	....	Smoke and ashes.
1859	August 15	Hood...........O.	2 days	....
1859	....	Baker..........W.	....	....
1860	....	Baker..........W.	....	....
1861	....	Olympus........W.	....	....
1865	....	Shishaldin......A.	....	....
1865	....	Makushin.......A.	....	....
1865	September 23	Hood...........O.	15 days	....
1869	....	Hood...........O.	3 hours	....
1873	Oct. 19, 4 P.M.	Tacoma........W.	7 days	....
1880	May	Tacoma........W.	....	....
1880	December	Baker ....W.	....	....
1884	June 16	Tacoma........W.	2 hours	Steam.
1891	Autumn	Baker..........W.	....	....
1891	August 2	Chimney Peak...C.	....	....
1891	....	Hozomeen......W.	....	Flame and smoke.
1892	August 27	Veniaminoff.....A.	3 days	....
1892	....	Bogoslov........A.	....	....
1893	March 9	Olympus........W.	....	....
1894	January 17	Jefferson........O.	....	Smoke and steam.
1895	Autumn	Bogoslov........A.	....	Flames and smoke.

CONCLUSION.

From the report of United States Surveyor-General Hardenburg, for the year ending June 30, 1871, the following is extracted:

"The shocks of 1800, 1808, and 1812 in California appear to have been about equal in force to the shock of 1868 (and it seems there have been no shocks during a century of greater severity).

"It is fair then to consider the shock of 1868 as a standard of the maximum force of earthquakes occurring in California during the last one hundred years. On the hypothesis that earthquakes are the results of natural laws, which operate with some degree of regularity, it may be fairly presumed that a period of one hundred years would, in all probability, give the extreme limit of the result of the action of these laws. Hence, having learned from reliable history and from observation the maximum strength of earthquakes occurring in California during a century past, we may, from these data, with some degree of confidence predict what their maximum strength will probably be during the hundred years to come. It will perhaps be no difficult matter to provide against any serious damage from these unwelcome visitors, by so constructing buildings that they shall be proof against any such shock of earthquake as has occurred in California during the last hundred years. Reasoning from the foregoing historical facts, I am firmly of the opinion that the earthquakes of California are not so much to be dreaded as is generally supposed; in fact, that they are far less dangerous to life and property than are the hurricanes of the South or the summer tornadoes of the North."

The earthquake of 1872, which occurred subsequent to the writing of this report, was far more severe than the shock of 1868, and should be taken to represent the maximum severity of any shock *which has actually occurred* in California during a century.

The *destructive* earthquakes on the Pacific Coast during the years 1769 to 1887 have been those of:

1800. October 11-31 (San Juan Bautista, etc.).
1812. October or December (San Juan Capistrano).
1818. ? (Santa Clara).
1836. June 9 and 10 (Monterey and northward).
1839. ? (Redwood City and San Francisco).
1857. January 9 (Ft. Tejon, Tulare, etc.).

1865. October 8 (San Francisco, etc.).
1867. January 8 (Klamath, etc.).
1868. October 21 (San Francisco, etc.).
1872. March 26 (Inyo County).

Probably the shocks of 1890, August 23 (Mono Lake) and of 1892, April 19-21 (Vacaville), should be included in this list. They are printed in the following one.

Extremely severe shocks have occurred:

1806. March 24 (Santa Barbara).
1812. December 21 (San Buenaventura).
1843. June 23 (California and Mexico).
1851. May 15 (San Francisco, etc.).
1852. November 9 (San Diego, Yuma, etc.).
1853. February 1 (San Luis Obispo County).
1853. October 23 (Eureka).
1855. January 24 (Sierra County).
1855. July 10 (Los Angeles County).
1856. January 2 (San Francisco).
1856. January 10 (Los Angeles County).
1856. February 15 (San Francisco).
1856. In the fall (Tulare County).
1856. December (San Diego County).
1858. November 26 (San José).
1861. July 3 (Amador).
1864. March 5 (Petaluma).
1865. May 24 (San Francisco).
1866. February 17 (Klamath).
1868. September 26 (Ukiah).
1869. October 8 (Ukiah).
1869. December 26 (Sacramento, Marysville).
1873. November 22 (Oregon and Washington Territory).
1885. January 30 (Honey Lake Valley).
1890. April 24 (Pajaro).
1890. August 23 (Mono Lake).
1891. October 12 (Sonoma).
1892. April 19-21 (Vacaville).
1893. April 8 (Newhall).

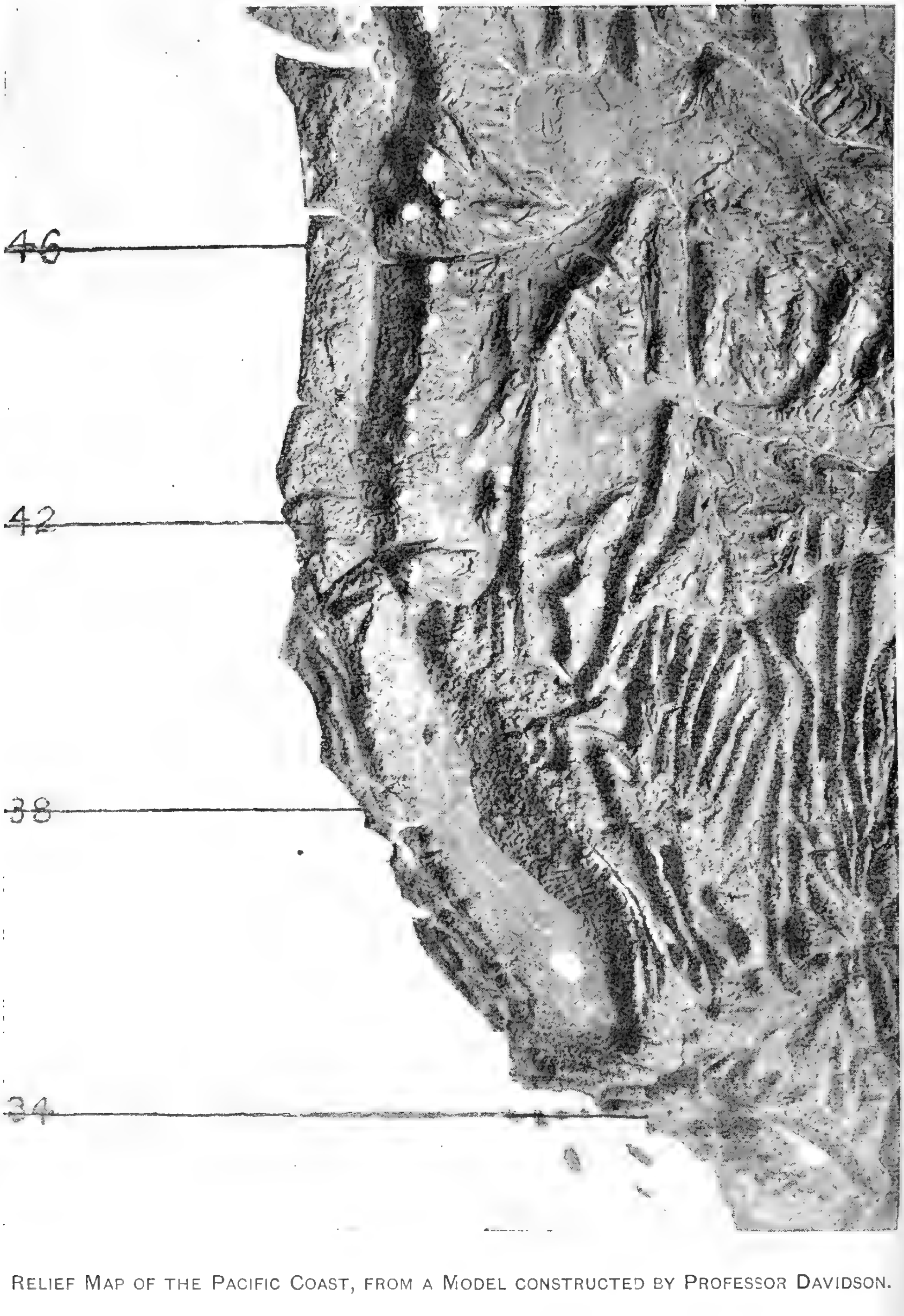
That is twenty-nine exceptionally heavy shocks (exclusive of what I have called destructive shocks) have occurred since 1800, or say, one every three and three-tenths years on the average, taking the whole region of many thousand square miles together. For any particular locality the number of really heavy shocks is quite small. Thus, at San Francisco there have been three destructive shocks and four exceptionally heavy earthquakes in one hundred years, although there have been very many slight shocks and tremors.

If we confine our attention to any other particular part of the State, the number of really heavy shocks occurring is very small indeed. When we take into account the whole damage to life and property produced by all the California earthquakes recorded, it is clear that the earthquakes of a whole century in California have been less destructive than the tornadoes or the floods of a single year in less favored regions.

EDWARD S. HOLDEN.

Lick Observatory, University of California,
December 31, 1896.

THE EARTHQUAKE AT POMPEII, A. D. 62.



RELIEF MAP OF THE PACIFIC COAST, FROM A MODEL CONSTRUCTED BY PROFESSOR DAVIDSON.

Catalogue of Recorded Earthquake Shocks on the Pacific Coast, 1769 to 1897.*

1769. April 11;
San Diego, Cal.—H. H. B.

1769. July 28; VI?
Four violent shocks in the Los Angeles region. Many more shocks were felt during the following week.—H. H. B.

1770.
At San Gabriel; which was called *El Valle de los Temblores* by Father Junipero Serro in a manuscript of 1778.—B. Ms.

1786. X.
Pavloff, Alaska, with volcanic eruption.—P.

1788.
Shumagin, Alaska, with tidal wave.—P.

1788. July 27;
Sannak Island, Alaska, overflowed by tidal wave.—P.

1788. July 27;
Ailiaska, Alaska, tidal wave.—P.

1790? X.
The Indians state that about eighty years before the shocks of 1872, March 26, in Inyo County, a similar earthquake occurred in the same region.—B. Ms.—*Alta*, April 6, 1872.

1796. May;
Bogoslov, Alaska, with eruption.—P.

1800. October 11 to October 31;
There were shocks from the eleventh to the thirty-first of October, sometimes six in a day, the most severe on the eighteenth, at San Juan Bautista.—H. H. B. Shocks October 11; another October 18,

* The Roman numerals I to X placed next after the dates represent the intensities on the Rossi-Forel scale as nearly as I have been able to assign them after a careful reading of the original accounts. These data are, of course, only approximate.

" at supper-time," and another at about 11 p. m. of the same day.—J. B. T., *Register*.

1800. November 22;

A shock in Southern California.—H. H. B.

1802.

Unalashka, Alaska.—P.

1803. April;

San Gabriel, Cal.—T. H. H.

1803. May 25; VIII.

An earthquake damaged the Mission Church at San Diego slightly. —H. H. B.

1806. March 24, midnight; VIII.

The church walls at Santa Barbara were cracked.—B. Ms. T. H. H. mentions a shock in March, with no date.

1808. From June 21 to July 17; VIII.

There were twenty-one shocks at the Presidio of San Francisco.—Trask, *Register*, p. 7.—H. H. B. and T. H. H. say eighteen. Adobe walls were seriously damaged.—B. Ms. The first translator of Argüello's communication to the Governor raised the number eighteen to twenty-one, and all the rest have repeated the error. —H. H. B.

1812. X.

Atka, Alaska.—P.

1812. May; VIII +.

Southern California was subject to nearly continuous shocks for four and one-half months. Four days seldom elapsed without at least one shock. The inhabitants abandoned their houses and lived out of doors.—Trask, *Register*, p. 7.

1812. September, October, or December? Sunday? IX.

Fatal earthquake. At San Juan Capistrano the church was destroyed, with loss of life (thirty to forty-five persons). The Mission Church at Santa Inez, near Santa Barbara, one hundred and seventy miles from San Juan Capistrano, was completely destroyed and some lives lost.—J. B. T., *Register*. A Spanish ship at anchor, thirty-eight miles from Santa Barbara, was injured by the shock.—J.B.T., *Register*. The year 1812 was ever after known as *el año de los temblores*.—H. H. B. See letter of Lieut. E. O. C. Ord, U. S. A. (November, 1849), in Tyson's Report, Geology of California, p. 125, where, however, it is called the shock of 1814. October 8, between 7 and 8 a. m., is the day of the great earthquake which destroyed the church of San Juan Capistrano, according to a careful article in the

San Francisco *Bulletin*, March 5, 1864. This date is often fixed in September or on December 8. The *Sundays* were: September 6, 13, 20, 27; October 4, 11, 18, 25; November 1, 8, 15, 22, 29; December 6, 13, 20, 27.

1812. October 8;

Shocks for forty days at San Juan Capistrano.—B. Ms.

1812. October 21; IX.

Specially hard shock at San Juan Capistrano.—B. Ms.

1812. December 8; VIII. ?

From San Diego to Purisima; most severe at San Juan Capistrano. It is not clear that it was felt at either San Diego or at San Luis Rey. At San Gabriel the church was badly cracked and lost the top of the tower.—H. H. B.

1812. December 21; VIII. ?

At San Fernando the church received serious damages. At San Buenaventura, three heavy shocks before January 1. At Santa Barbara, a long series of shocks, beginning on the 21st and lasting several months.—H. H. B.

Santa Inez; two shocks, fifteen minutes apart, beginning at 10 a. m. At Purisima (IX), at 10.30 a. m., December 21, the earth shook for four minutes so violently that it was difficult to stand. Half an hour later another more violent shock. A succession of light shocks this day and the next.—H. H. B.

P. Gil reported that there was a huge earthquake wave at sea. A stick with a pendant ball was set up at the Mission (Santa Barbara), and the ball vibrated continually for eight days, and later, at intervals for fifteen days. A ship at Refugio (IX) was carried up a cañon by the wave and returned to sea.—H. H. B.

Several asphaltum springs formed in the mountains and tulares; gaps in the Sierra; the " shore volcano " has more openings, and another is reported behind the Sierra de los Pinos.—H. H. B. [? ?]

1812.

San Francisco. Señora Juana Briones relates that in 1812 the earthquakes were so severe as to cause tidal waves which covered the ground where the plaza now is.—(Communicated by J. R. Jarboe, Esq.)

1813 or 1815. IX.

John Gilroy says an earthquake shook down all the buildings " in the region " (probably Santa Clara Valley) in one of these years. —B. Ms.

1815. January 18;

Five shocks at Santa Barbara.—H. H. B.

1815. January 30;
More shocks at Santa Barbara.—H. H. B.

1815. July 8, 9;
Six shocks at Santa Barbara.—H. H. B.

1817. April; X.
Umnak, Alaska.—P.

1818.
Makughin, Alaska.—P.

1818. VIII.
The church of Santa Clara was damaged.—T. H. H. "I think there is no authority for such a statement."—H. H. B., vol. 14, p. 377. A new Mission church had been contemplated in 1818. It is said that the old church was so badly injured by an earthquake in 1822 that it was best to take it down; and that a new church (now standing) was built in 1825–6. "For various reasons [which are given] I suppose nothing of the kind to have occurred. As a mere conjecture, it may be that after the church was completed, or nearly so, in 1818 it was damaged by an earthquake, and not fully repaired until 1822."—H. H. B., vol. 14, p. 602.

1821. January 1;
A severe shock at San Buenaventura and San Luis Rey, Cal.—H. H. B.

1824.
There are newspaper accounts of earthquakes in 1824.—H. H. B.

1826. June;
Unalashka, Alaska. Two shocks.—P.

1827. June;
Copper Island, Alaska.—P.

1829. September;
Several very severe shocks of earthquake were experienced in San Francisco, Cal.—*Annals of San Francisco.*

1830. VIII.
The church of San Luis Obispo was injured.—T. H. H.

1833. June 29; "13h. 40m. Os."; II.
Fort Nisqually, Washington.—P.

1836. April 2; X.
Pribyloff Islands, Alaska.—P.

1836. April 25; 5 a. m.
Monterey, Cal.—H. H. B.

1836. August; X.
Pribyloff Islands, Alaska.—P.

1836. June 9 and 10;
Severe shocks from Monterey northward.—H. H. B.

1836. VIII.
An earthquake comparable with the shock of 1868, October 21, was felt in the same region of country; great fissures were made in the earth, and the shocks continued for a month.—B. Ms.

1838. June and July; VIII.
Shocks at San Francisco, San José, Santa Clara, and Monterey, Cal. —H. H. B. Very severe in the harbor of San Francisco.—Verbal account of Don José Thompson.

1839. ?; shortly after 12 m.; IX.
Where Redwood City now is. Destructive. Adobe walls seven feet thick were cracked from top to bottom. The earth was cracked in many places, and one immense fissure extended from Lone Mountain (?) to the Mission San José.—B. Ms.—San Francisco *Call*, December 21, 1879.

1839. ?; VIII.
A very severe earthquake in San Francisco, Cal.—*Annals of San Francisco.*

1840. January 16-18; IX.
An earthquake and tidal wave at Santa Cruz. The church tower overthrown.—H. H. B.

1841. May 12; 9 p. m.; III.
A very short, slight shock at Monterey, Cal.—Duflot de Mofras, *Exploration de l'Oregon.*—R. M.

1841. July 3; 2h. 7m. p. m.; VII.
A shock at Monterey, Cal. Felt at sea.—Duflot de Mofras, *Exploration de l'Oregon.*—R. M.

1841.
Violent eruptions of Mt. Raynier, Oregon.—Perrey. [?]

1841. Summer; III.
Monterey, Cal. "The shocks of one hundred and twenty earthquakes were felt during two successive months of . . . summer. The average, however, of two earthquakes a day is not so frightful as it looks, the shocks being seldom severe, and often so slight as to escape the notice of the uninitiated stranger."—Simpson's *Journey Round the World*, vol. I, p. 344.

1842. September 28;

Eruption of Mt. St. Helens, Oregon.—Perrey. [?]

1842. November 23;

Eruption of Mt. St. Helens.—Perrey. (1843?) [?]

1842.

Eruption of Mt. Baker, W. T.—Perrey. [?]

1843. June 23; 3:30 p. m.; VIII? or more severe?

Very severe earthquake in California, which extended to Mexico.—Perrey.

1843. November 23;

Eruption of Mt. Raynier.—Perrey. (See 1842, November 23, and 1841.) [?]

1843.

Eruption of Mt. Baker, Oregon.—Perrey. [?]

1846-52; exact date not given.

In Oregon City, on Rock Creek, near Portland, Oregon, explosions like those of a cannon were heard for nearly the whole of a day. At first these were about half an hour apart; then they came nearer together, until at last they were no further apart than one minute or so; finally they died away. The water in Rock Creek did not run for three days.—Verbal account of Geo. J. Ainsworth, Esq.

1847. VI.

St. Paul's Island, Alaska.—P.

1848. January 4; III.

Slight shock at Los Angeles.—B. Ms.

1849. September 16; evening.

At Santa Isabel, between San Diego and the mouth of the Rio Gila. —Perrey.

1849. September 22; 3 p. m.

Twelve miles from Curisco Creek, in the desert between Santa Isabel and the Gila.—Perrey.

1850-1854.

"A Recent Volcano in Plumas County, Cal." by Dr. H. W. Harkness. Dr. Harkness describes his visit to a spot near the borders of Lassen and Plumas counties, directly across the northern end of Snag Lake (Lake Anna), twelve miles east of Lassen's Butte, and gives his own observations, showing a *recent* eruption, together with the evidence of other persons, all going to prove an active eruption about 1851.—*Proc. Cal. Acad. Sci.*, vol. 5, pp. 408-412.

1850. January 16; 11h.; 2h. a. m. ? p. m.?
San Francisco, three shocks.—Perrey.

1850. February 15;
Several shocks, San Francisco, Cal.—Perrey.

1850. March 21; III.
A light shock in San José, Cal.—J. B. T.—Perrey.

1850. May 13;
San Francisco and San José; also slight eruption of Mauna Loa.—J. B. T. Perrey says: "In March and then May 12 and 13, six shocks in San José and San Francisco during eruption of Mauna Loa."

1850. June 28; III.
A light shock in San Francisco, Cal.—J. B. T.—Perrey.

1850. August 4; V.
Stockton and Sacramento, smart shocks.—J. B. T.—Perrey.

1850. August 15;
San Diego, Cal., and on the Gila.—Perrey.

1850. September 14; V.
Smart shock in San Francisco and San José.—J. B. T.—Perrey.

1851. March;
Several shocks in this month in California.—Perrey.

1851. April;
Shocks in California during April.—Perrey.

1851. May 13;
San Francisco and Salinas.—Perrey.

1851. May 15; 8:10 a. m.; VII.
San Francisco.—T. T.—J. B. T.—8.20 a. m.—Perrey. Coincident with an eruption of Mauna Loa. Severe shock, lasting about half a minute, felt by shipping in the harbor. Bottles were thrown from shelves to the floor.—B. Ms. Perrey says three shocks, in *Mém. Cour.*, vol. 8, p. 28.

1851. May 17; III.
A slight shock in San Francisco, Cal.—J. B. T.—Perrey.

1851. May 28; III.
A slight shock on the Salinas, Cal.—J. B. T.—Perrey.

1851. June 13; V.
Smart shock in San Francisco, San Luis Obispo, and San Fernando, Cal.—J. B. T.—Perrey.

1851. November 12; 7 p. m.; V.
San Francisco, Cal.—Perrey. Severe.—B. Ms.

1851. November 13; 7 p. m.
San Francisco, motion of the waters in the bay.—Perrey.

1851. November 15; 2 a. m.
San Francisco, Cal.—Perrey.

1851. November 15; 10 p. m.
San Francisco.—Perrey. Also, T. T.

1851. November 26;
Coast of California from + 37° to + 40° latitude, eleven shocks.—Perrey.

1851. December 2;
A shock at Downieville, Sierra County, Cal.—J. B. T.—Perrey.

1851. December 26; 7 and 8:10 p. m.
Two light vibrations in San Francisco.—T. T. "One shock in the morning, one at 20 minutes before 10 at night, and one at 35 minutes past 11."—B. Ms. Three shocks: "The first quite severe, at about 3 o'clock (a. m. ?); next about 10 (p. m. ?); last about noon."—B. Ms.—*Alta*, December 26, 1851. During the past two years the direction of the shocks has been invariably from north to south.—B. Ms.—*Alta*, December 28, 1851.

1851. December 30; 3 a. m.
San Francisco.—Perrey. (See December 26.)

1851. December 31; 3 a. m.; 9:35 a. m.; 11:40 a. m.?
Three shocks at San Francisco.—Perrey. (See December 26.)

1851. December 31; V.
Smart shock at Downieville, Sierra County, Cal.—J. B. T.

1852. April 12; midnight.
San Diego, Cal.—Perrey.

1852. October 26;
Eleven shocks at San Simeon; an equal number at Los Angeles and San Gabriel. Felt also at San Luis Obispo, San Diego, and Colorado River. During the next six days all the southern part of California shaken at short intervals.—Perrey. (See November 26.)

1852. November 9; VIII or IX?
Violent shock at Fort Yuma. The shocks continued almost daily for many months. The first shock threw down a portion of Chimney Peak and opened fissures and cracks in the clay desert bordering the Colorado. A small mud volcano was found in an active state

about forty miles southwest of the post.—Report of Exp. for Pacific Railroad, vol. V., p. 115. *See* Hittell's Resources, p. 44.

1852. November 20;
In Southern California, beginning of a series of thirty-two shocks.—Perrey.

1852. November 22; 11 p. m.; VIII.
Severe shock eight miles southeast of San Francisco. Next morning a fissure half a mile wide and three hundred yards long was discovered, through which the waters of Lake Merced were flowing to the sea.—B. Ms.—*Alta*, November 27, 1852; also November 28.

1852. November 23; a little before midnight.
Shock in California, accompanied by thunder and lightning.—Perrey.

1852. November 24;
San Francisco, Cal. Perrey says the waters of Lake Merced disappeared. (See November 22.)

1852. November 26; (October 26?)
Eleven strong shocks at San Simeon, Los Angeles, and San Gabriel, Cal.—J. B. T.—Perrey says November 20 was the beginning of a series of thirty-two shocks in Southern California.

1852. November 27-30; IX.
Continued shocks disturbing an area of over three hundred miles square, extending east from San Luis Obispo to the Colorado River, and north to San Diego.—J. B. T. The shocks opened fissures at least thirty miles long in Lockwood Valley.—Verbal account of J. De B. Shorb, Esq.

1852. November 29; about noon; IX.
San Diego. Shock lasted about two minutes. "The earth seemed to vibrate to and fro some five or six inches." This shock was followed by lighter ones about sunrise, for several days.—B. Ms.

1852. November 29; 12:20 p. m.
Fort Yuma and San Diego.—Perrey.

1852. December 5; about 11 p. m.
Fort Yuma.—Perrey.

1852. December 17; V.
Two smart shocks at San Luis Obispo, Cal.—J. B. T.—Perrey.

1852. December;
During the month of December the southern and middle portions of California were much disturbed, and the effects were felt as far north as the thirty-seventh parallel. The shocks continued into the month of January, and were noticed until the fifth of this month on the San Joaquin.—J. B. T.—Perrey.

1852. December 26;
Los Angeles, Cal.—Perrey.

1852.
Fort Yuma. Eruption of a mud-volcano in the Colorado Desert.—Perrey, *Mém. Cour.* 13, p. 19.

1853. January 1;
San Gabriel.—B. Ms.

1853. January 2; IV.
Moderate shock in San Francisco, Bodega, and Shasta City, Cal.—J. B. T.—Perrey.

1853. January 5;
San Joaquin; Corte Madera.—J. B. T.—Perrey.

1853. January 10;
At Captain Dana's rancho, San Luis Obispo County, Cal.—B. Ms. *Alta*, February 24, 1853.

1853. January 29;
Santa Barbara, Cal.—Perrey.

1853. January;
Shocks at San Luis Obispo, Cal.; also at Mariposa and San Francisco.—Perrey.

1853. February 1; 1 p. m.; VIII.
Violent shocks at San Simeon, San Luis Obispo County. Houses were injured.—B. Ms.—*Alta*, February 24, 1853.

1853. February 14;
San Luis Obispo.—J. B. T.—Perrey.

1853. March 1; V.
Smart shock at San Francisco, San Luis Obispo, and Santa Barbara.—J. B. T.—Perrey.

1853. April 24; III.
Light shock at Humboldt Bay, Cal.—J. B. T.—Perrey.

1853. April 25; 26?; III.
Three light shocks at Weaverville, Trinity County, Cal.—J. B. T.—April 26.—Perrey. April 26.—B. Ms.

1853. June 2; at night.
San Francisco, Cal.—B. Ms.—Perrey.

1853. June 2;
Two smart shocks in the plains of the San Joaquin.—J. B. T.—Perrey.

1853. July 12; III.
A light shock in Yreka, Siskiyou County, Cal.—J. B. T.—Perrey.

1853. July 12;
San Joaquin, Cal.—Perrey.

1853. September 2? or 3?;
Four shocks in Salinas and San Joaquin Plains.—J. B. T.—September 2?—Perrey. September 2?—B. Ms.

1853. October 2;
San Joaquin, Cal.—Perrey. [Possibly this refers to September 2, q. v.—E. S. H.]

1853. October 23; VIII.
Three heavy shocks at Humboldt Bay, Cal.—J. B. T. At Eureka it is said the houses rolled like ships at sea and the wharf sank 4 feet.—B. Ms. Also at Acapulco, Mexico, and Peru.—Perrey.

1853. October 25; III.
A light shock at Humboldt Bay, Cal.—J. B. T.—Perrey.

1853. November 16; III.
A light shock at San José, Cal.—J. B. T.—Perrey.

1853. November 18; III.
Slight shock at San José.—B. Ms.

1853. November 20; 11 p. m.
San Francisco, Cal. More than thirty shocks since January 1.—Perrey.

1853. November 21;
A shock at San Francisco, Cal.—J. B. T.—Perrey.

1853. November 23;
Shasta, Cal.—Perrey.

1853. November 25;
San Francisco.—Perrey.

1853. December 11;
San Francisco and Mission Dolores.—J. B. T.—Perrey.

1853. December 23; III.
A light shock at Shasta City, Cal.—J. B. T.—Perrey.

1853. December;
Many shocks in Fort Yuma region; geysers formed.—B. Ms.—Also *Second Annual Report of State Mineralogist of California*, 1880-2, p. 233.

1853;

Perrey refers to eruptions of Hood, St. Helens, Mt. Baker, etc.—*Am. J. Sc.*, 2d series, v. 20, p. 297, September, 1855.

1854. IV.

Kaviak, Alaska.—P.

1854. January 3; V.

Two smart shocks at Mariposa and Shasta, Cal.—J. B. T.

1854. January 9; 3:30 a. m.

San Francisco, Cal.—T. T.—Perrey.

1854. February 5; 6:50 p. m.

San Francisco, Cal.—B. Ms.

1854. March 2; III.

A light shock in San Francisco, Cal.—J. B. T.—Perrey.

1854. March, about the 16th;

San Francisco.—Perrey.

1854. March 16; night.

San Francisco, Cal.—Perrey.

1854. March 20;

Stockton, Cal.—J. B. T.—Perrey.

1854. February-April;

Mountain of St. Helens, Oregon, was in eruption about February-April.—Perrey. [?]

1854. March;

St. Helens, Oregon, in eruption.—Perrey. [?]

1854. April 10;

Two shocks at San Francisco, Cal., 10.30 a. m. and 10.45 a. m., the second the severest.—B. Ms.—*Alta*, April 11, 1854. More violent at Point Lobos.—Perrey.

1854. April 10;

Mt. St. Helens still in eruption.—Perrey. [?]

1854. April 14; 10-11 a. m.

Two shocks, San Francisco, Cal.—Perrey.

1854. April 20;

Santa Barbara, Cal.—Perrey.

1854. April 29; III.

A light shock at Santa Barbara, Cal.—J. B. T.—Perrey.

1854. May 3; 5h. 10m.; V.
Three severe shocks at Santa Barbara, Cal.—J. B. T.

1854. May 13;
Santa Barbara, Cal.—Perrey.

1854. May 23;
A shock at Crescent City, Humboldt County, Cal.—J. B. T. And San Francisco, Cal.—Perrey. 11h. 20m. p. m.—Perrey.

1854. May 29;
Santa Barbara, Cal.—Perrey.

1854. May 31; 4.50 a. m.
Three shocks at Santa Barbara, Cal.—J. B. T.—Perrey.

1854. June 26;
Two light shocks in Placer County, Cal.—J. B. T.—Perrey.

1854. July 10;
Shock at Georgetown, El Dorado County, Cal.—J. B. T.—Perrey.

1854. July 14;
Shock at Georgetown, El Dorado County, Cal.—J. B. T.—Perrey.

1854. August;
Smoke [?] on Mount Hood.—Perrey.

1854. September 14; III.
A light shock at Nevada (Cal.?)—J. B. T.—Perrey.

1854. October 2;
Humboldt, Cal.—Perrey.

1854. October 21; III.
A light shock at Monterey, Cal.—J. B. T.—Perrey.

1854. October 21; 7:30 p. m.; VI.
San Francisco, Cal.—T. T. 7.35 p. m.—Perrey. "The severest since 1851."—B. Ms., *San Francisco Daily Herald*, October 22, 1854.

1854. October 26; V.
Smart shocks at San Francisco and Benicia, Cal., followed by a sea wave.—J. B. T.—Perrey.

1854. November 1?;
Angel Island.—B. Ms., *Alta*, November 1, 1854; *Nevada Journal*, November 10. A calm sea and no wind at first; then water rose several feet with high waves, lasting half an hour.

1854. November 11; 4¼h. p. m.
San Francisco.—Perrey.

1854. December 23;

Violent shock occurred in Japan. In the harbor of Simoda the water was agitated so that its depth varied between 8 and 40 feet. The waves were transmitted across the Pacific and registered on the tide gauges of the United States Coast Survey at San Francisco, Astoria, and San Diego. The velocity of the sea wave was: Simoda to San Francisco, 368 miles per hour, 5.966 miles per minute; Simoda to San Diego, 355 miles per hour.—A. D. Bache, in *Am. Jour. Sci.*—Perrey.

1855. January 2; just before 10 a. m.; III.

Two slight vibrations five seconds apart. San Francisco, Cal.—B. Ms.—*San Francisco Golden Era*, January 6, 1855.

1855. January 13; 18h. 30m.; V.

Smart shock at San Benito and San Miguel, Cal. It was also felt at San Luis Obispo.—J. B. T.

1855. January 14; 10 p. m.; V.

Along ninety-four miles of the coast of California.—Perrey.

1855. January 24; 22h.

A heavy shock, lasting seven seconds, was felt at Downieville, Sierra County, Cal. This shock was quite severe at Gibsonville on the north, at Forest City and Minnesota, in Sierra County; and at Orleans Flat and Eureka, Humboldt County; in Nevada County; at Georgetown and Nashville in El Dorado County on the south; and at Keystone Ranch, in Yuba County, on the west.—J. B. T.

1855. February 5; 10 a. m.; III.

A light shock at Wolf Creek, and the northeast part of Nevada County, Cal.—J. B. T.

1855. April 7; 6 p. m.; III.

A light shock at Gibbs Ferry, Trinity County, and as far north as Calahan's Ranch, at the head of Scott's Valley, Siskiyou County.—J. B. T.

1855. June 9; 5 a. m.; III.

Fort Yuma; slight shock. *Report of explorations for railroad near the 32d parallel*, Appendix I, p. 9, vol. VII.

1855. June 25; 14h.; V.

Smart shock at Santa Barbara, and north to the Valley of Santa Maria.—J. B. T.

1855. July 10; 9h. 30m.; III.

A light shock at Georgetown, El Dorado County, Cal.—J. B. T.

1855. July 10; 20h. 15m.; VIII.

Severe shock at Los Angeles. Four shocks were felt in about twelve seconds; two unusually heavy sea waves rolled in at Point San Juan, just after the last shock.—J. B. T. This shock was accompanied by rain.—B. Ms. Bells at San Gabriel Mission Church thrown down.—B. Ms. See August 12.

1855. July 13; III.

Slight shock at Gibsonville, Sierra County, Cal.—*S. F. Daily Herald*, July 23, 1855.

1855. August 12; 9:30 a. m.; III.

A light shock at Georgetown, Cal.; four light shocks at Georgetown, from July 10 to August 12, dates not recorded.—J. B. T.

1855. August 26; 1 p. m.

Sonoma County; Petaluma.—B. Ms.—*Sacramento Union*, September 8, 1855.

1855. August 27; 3 p. m.; VI.

Violent shock, Sonoma County, Cal.—*Sacramento Union*, September 8, 1855. Also violent at Petaluma and at Mission San Francisco de Solano.

1855. August 28;

San Francisco, Cal.—B. Ms.

1855. October 5; 7¾h. p. m.

San Francisco.—Perrey.

1855. October 21; 19h. 45m.; V.

Smart shock in San Francisco. Much commotion in the water of the bay a few minutes preceding the shock.—J. B. T.

1855. October 27; 3 p. m.; III and IV?

A light shock in the Valley of Clear Lake; a light shock at Downieville, Sierra County; more severe shock at Goodyear's Bar.—J. B. T.

1855. December 5; 11:20 a. m.

A shock at Humboldt Bay, Cal.—J. B. T.

1855. December 11; 4h.; VI.

San Francisco; quite severe at Mission Dolores.—J. B. T.

1855. December 21; 11h. 20m. a. m.

Humboldt Bay, Cal.—Perrey.

1856. January 2; 10h. 15m.; VII.

Smart shock at San Francisco, Cal.—J. B. T. Light shock at 10 a. m.—T. T. "Severe."—B. Ms.—San Francisco *Daily Herald*, January 3, 1856. Goods were shaken from the shelves.—B. Ms. 9 a. m. and 10 a. m.—Perrey.

1856. January 10; 5 a. m.
Slight shock; and another at about 8 a. m. [at San Francisco?]. This was very severe at Los Angeles and throughout the southern part of the State (VI).—B. Ms.

1856. January 21; 16h.; V.
Smart shock in San Francisco, Cal.—J. B. T.

1856. January 23; 4 p. m.
Mission [Dolores?] Cal.—Perrey.

1856. January 28; 3h.; V.
Smart shock at Petaluma, Sonoma County, Cal.—J. B. T.—Perrey.

1856. January 29; 0h. 45m.; III.
Slight shock at San Francisco, Mission Dolores.—J. B. T.—Perrey.

1856. January 31; 4 p. m.
[San Francisco?].—Perrey.

1856. February 15; 5h. 25m. a. m., in S. F. (See 1858, November 26.)
In San Francisco (VIII), severe shock of eight seconds; a previous shock at 2.08 a. m. Heavy shock at Monterey, Cal. (V), 5.20 a. m. Shock at Bodega, Cal. (IV). Twenty-two vessels off the coast, from San Pedro to southern Oregon, felt no shock. Shock at Santa Rosa (IV?) and no further N.; light shock at Stockton, and no further E.; shocks at San José.—Trask, *Register*, p. 15.—Perrey. Two shocks in San Francisco, one at 2.15 a. m.; one at 5.23 a. m., lasting twelve seconds. Not felt at Sacramento, slight at Stockton; severe at San José (VI), hardest at Oakland (VII).—B. Ms. Severe at S. F., 5.35 a. m.—T. T. The water in the Bay of S. F. rose, maintained its level for five minutes, and then sank two feet below its ordinary stage.—B. Ms.

1856. March 15;
San Francisco.—Perrey.

1856. March 24; 22h. 20m.; III.
A slight shock was felt at Canal Gulch, Siskiyou County; also at Yreka.—J. B. T.—Perrey.

1856. March 30; 8:30 p. m.
S. F., Cal.—B. Ms.—*Sacramento Union*, April 2, 1856.—Perrey.

1856. March 31: 12:30 a. m.
S. F., Cal.—B. Ms.—*Sacramento Union*, April 2, 1856.

1856. March 31; 1:30 a. m.
S. F., Cal.—*S. F. Daily Herald*, April 1, 1856.

1856. April 6; 23h. 30m.; V.
Smart shock at Los Angeles, El Monte, Cal.—J. B. T.—Perrey.

1856. April 14;
Los Angeles, Cal.—Perrey.

1856. May 2; 0h. 10m.; V.
Severe shock at Los Angeles.—J. B. T.

1856. May 9; night.
Los Angeles.—B. Ms.

1856. May 10; 21h. 10m.; III.
Light shock at San Francisco.—J. B. T.; and Monterey.—Perrey.

1856. August 2; 5h. 20m.; III and IV?
A light shock in San Francisco, Cal.; more severe at Stockton.—J. B. T.—Perrey.

1856. August 27; 21h. 15m.; IV.
Moderate shock, twice repeated, from the west, at Mission San Juan, Monterey, Santa Cruz.—J. B. T. Another strong shock [where?] in the night of August 29.—Perrey.

1856. September 6; 3h.; V.
Smart shock at Santa Cruz, Cal.—J. B. T.—Perrey.

1856. September 20; 23h. 30m.; VII.
Very severe shock in San Diego County, Cal.—J. B. T.—Perrey.

1856. September 22; evening; III.
San Diego, Cal.; light shock.—Perrey.

1856. September 25; 11:30 p. m.
San Diego County.—B. Ms.—S. F. *Bulletin*, October 18, 1856.

1856. September 28;
Slight shocks in parts of Southern California.—B. Ms.

1856. September 29;
Slight shocks in parts of Southern California.—B. Ms.

1856. October 1;
Slight shocks in parts of Southern California.—B. Ms.

1856. October 18; "morning"; III.
Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, October 22, 1856.

1856. November 12; 4h.; V.
Smart shock, Humboldt Bay, Cal. Another shock was reported, but no date given.—J. B. T.—Perrey.

1856. December 26;
Port Townsend, Washington.—Perrey.—P.

1856. December ?; about 10 p. m.

Foot of Clear Lake, Lake County, Cal.—B. Ms.—S. F. *Bulletin*, September 3, 1859. This shock was not felt at Big Valley, thirteen miles away.—B. Ms.

1856? December?; VII.

Very severe in San Diego, Cal.—Verbal account of Don José Thompson.

1856. In the fall; IX.

Tulare County. The line of the shock " was marked by a fracture of the earth's surface, continuing in one uniform direction for a distance of some two hundred miles."—B. Ms.—Barton, *History of Tulare County*, p. 11.

1857. January 8; 11:20 p. m.; also January 9; VIII? IX?

Heavy earthquakes in California. All the houses in Santa Barbara were damaged.—Perrey.

At Ft. Tejon this shock was more severe than the shocks of 1812.—B. Ms.—*Nevada Journal*, May 8, 1857. Two persons killed by being buried in the ruins of a house.—B. Ms.—*Los Angeles Express*, December 4, 1875? [1857?]. Visalia, Tulare County, it was difficult to stand erect; tree tops waved several feet to and fro; it was equally severe at places within fifty miles north and south.

1857. January 8; 6 a. m., 9 a. m., 10 a. m.

Three shocks at Santa Barbara; and in the afternoon two slight shocks and one severe one; 8.30 a. m., Los Angeles; 8.15 a. m., San Francisco; 7 a. m., Monterey; 7.30 a. m., Sacramento.—Perrey. San Francisco, 8 a. m.—T. T. At Los Angeles, five or six shocks during the day, and within eight days about twenty shocks.—B. Ms.—*Sacramento Union*, February 5, 1857.

1857. January 8 and 9;

California. Dr. Trask shows that the velocity of the earth wave was: San Francisco-Sacramento, 6.6 miles per minute; San Francisco-Stockton, 6.5 miles per minute; San Francisco-Tejon, 6.0 miles per minute; San Francisco-San Diego, 7.0 miles per minute. Or, on the average, 6.2 miles per minute, or 545.6 feet per second. —*Amer. Jour. Sci.*, vol. 25, p. 146.

1857. January 9; 8:20 a. m.

At Stockton, and Benson's Ferry on the Mokelumne, several shocks on the night 8-9, the principal one at 8.15 a. m.; 8.30 a. m., very severe at Sacramento; 7 a. m., at Los Angeles and Monterey.—*S. F. Bulletin*, January 9, 1857. San José, Cal.—*Sacramento Union*, September 20, 1858.

1857. January 9;

Ft. Tejon, the earth opened in cracks twenty miles long; buildings and chimneys were thrown down; beds of streams changed.—B. Ms.—*Los Angeles County History*, p. 545.

1857. January 9; IX.

Fort Tejon. On ninth January, 1857, an earthquake shook the earth from Fort Yuma (IX) to Sacramento (VI). It was most severe at Fort Tejon (IX). A loud rumbling accompanied the shock at Tejon, San Bernardino, Visalia (IX) and Mojave Valley. The waters of the Mokelumne River were thrown upon the banks, so as to leave the bed bare in one place. The current of Kern River was turned up stream, and the water ran four feet deep over the bank. The water of Tulare Lake (IX) was thrown upon its shores; and the Los Angeles River (IX) was flung out of its bed. Some of the artesian wells in Santa Clara Valley ceased to run, and in other places the water increased. Near San Fernando, a large stream of water ran from the mountains, where there was no water before. In San Diego and San Fernando, several houses were thrown down (IX), at San Buenaventura (IX) the roof of the Mission Church fell in. Several new springs were formed near Santa Barbara. In the San Gabriel Valley the earth opened several miles long; and in one place the river left its bed and followed the new opening. A large fissure was made in the western part of San Bernardino. At Fort Tejon nearly all buildings were thrown down, large trees overthrown, and the earth opened in a fissure twenty feet wide and forty miles long; the sides then came together with such violence that a ridge was formed ten feet wide and several feet high. At Reed's ranch, near Fort Tejon, a house was thrown down and a woman in it killed.—B. Ms.—Hittell's *Resources*, pp. 42-43. At San Benito (VIII or IX?), 15 or 20 miles N. W. of San Benito, Dr. Canfield's Diary says 3 shocks, the first about sunrise [which was at 7.23 a. m.], lasting not over 5 seconds, accompanied by noise. The second about 8 a. m., "very much more violent—pieces of mortar fell from the walls—I was almost thrown from my seat—this lasted for a minute or two [!] and I then went out of doors, when the oscillation returned and lasted perhaps a minute, but was quite gentle." The direction was S. to N. A person lying down reported a shock at 10 a. m., which was not felt by persons in motion (II).

1857. January 16; V.

Severe shock at Los Angeles.—B. Ms. 5 p. m.—Perrey.

1857. January 17; night.

Two shocks; January 18, 8 a. m.; [at Los Angeles?]—Perrey.

1857. January 18; 9 a. m.; III.

A light shock at Martinez and Benicia, Cal.—J. B. T. Monterey.—Perrey.

1857. January 20; 8h. 30m. a. m.; V.

Strong shock at Santa Cruz and Mission San Juan, Cal.—J. B. T.

1857. January 20; VI.
Severe shock, Ft. Tejon.—B. Ms.—*Los Angeles County History*, p. 545.

1857. January 20; 3:30 p. m.
Mission San Juan.—Perrey.

1857. January 21; III.
15 or 20 miles N. W. of San Benito. About 7h. 20m. a. m.? p. m.? a slight shock lasting a few seconds.—Dr. Canfield's Diary.

1857. January 21; evening; V.
Smart shock at Mariposa, Cal.—J. B. T. 11 p. m.—Perrey.

1857. February 5; 7 p. m.
San Francisco, Cal.—J. B. T.—T. T. 6.55 p. m. Two shocks at S. F., Oakland, and Stockton, Cal.—Perrey.

1857. March 5; about 7 p. m.
Two short shocks in San Francisco, Cal.—Perrey.

1857. March 14; 15h.; V.
Severe shocks at Santa Barbara and Montecito.—J. B. T.

1857. March 23; 12:27 a. m.; III.
A light shock in San Francisco, Cal.—J. B. T.

1857. April 1; VI.
15 or 20 miles N. W. of San Benito. About 3.35 a. m. a severe shock lasting about 8 sec.—Dr. Canfield's Diary.

1857. April 24?.
A shock was recently felt at San Gabriel and San José, Cal.—Perrey.

1857. May 2; morning.
Two shocks at Los Angeles.—B. Ms.

1857. May 3; 22h.; VI.
Smart shock at Los Angeles and El Monte, Cal.—J. B. T. "Violent shock."—Perrey.

1857. May 23;
Slight shock at Los Angeles (III). Severe shock at Fort Tejon (VI). —J. B. T. "Four shocks at Los Angeles."—B. Ms.

1857. June 14; VI.
Severe shock at Humboldt Bay, Cal. Several severe shocks at the Penal Island (Carmen), Gulf of Cal.—J. B. T.

1857. July 5; 7h.; VI.
Severe shock at San Francisco, Cal.—J. B. T.

1857. August 8; 11h.; V.
Smart shock at Rabbit Creek, Sierra County, Cal.—J. B. T.

1857. August 29; VI.
Severe shock at Tejon Reserve, Cal.—J. B. T.

1857. September 2; 19h. 45m.; III.
Slight shock at San Francisco, Sacramento, Marysville, Nevada, San Juan, Downieville, and Camptonville, Cal.—J. B. T.

1857. September 7;
San Francisco.—Perrey.

1857. September 7;
Violent earthquake in California?? quoted from meteorological observations in 71st report Univ. of N. Y., p. 359, by Perrey, who, however, thinks the date doubtful.

1857. September 14; 2 p. m.; III.
A slight shock in San Francisco, Cal.—J. B. T. At 2.15.—T. T.

1857. September;
Birch Bay, Washington.—P.

1857. October 19; 18h. 30m.; VI.
Severe shock at San Francisco, Cal.—J. B. T. 6.15 p. m.—T. T.

1857. October 20; 12h. 8m.; 12h. 35m.; 13h. 15m.; III?
Three shocks felt at San Francisco and San José, but not in Oakland; the last the most severe.—J. B. T. Light shock 1.20 a. m.—T. T.

1857. November 2; 6:25 p. m.; III.
S. F., Cal., in the night several light shocks.—Perrey.

1857. November 3; 1:16 a. m. and 3 a. m.
S. F., Cal.—Perrey.

1857. November 8; 3:45 a. m.
San Francisco, Oakland, and Bodega, Cal.—J. B. T.

1857. November 9; 0:45 a. m.
San Francisco, Cal.—T. T.

1857. November 9; 2:30 a. m.
San Francisco, Cal.—T. T.

1857. November 15; a little after 6 p. m.
San José.—B. Ms.

1857. December 23; 7 a. m.; III.
A light shock in San Francisco, Cal.—J. B. T.

1857. December 24; 5:40 a. m.? p. m.?
Four shocks; S. F., Cal.—Perrey.

1857. December 30; 5:40 a. m.
S. F., Cal.—Perrey.

1857.
"Accounts from Fort Tejon report frequent shocks in that section of the country." Dr. Trask does not mention them in his notes on earthquakes in California during 1857.—Perrey.

1858. January 1 or 2;
San Francisco.—Perrey.

1858. January 13; 9 p. m.
S. F., Cal.—S. F. D.

1858. February 10; V.
Smart shock at Kanaka Flat, Sierra County, Cal.—J. B. T.

1858. February 15; 4h. 20m.; IV.
A light shock in San Francisco, and also in San Mateo County, Cal. J. B. T.—Perrey.

1858. August 18; 10:45 p. m.; VI.
Two shocks, first light, second heavy enough to waken sleepers, Sonoma County.—B. Ms. 10.55 p. m.—*S. F. Directory.—Sacramento Union*, August 23, 1858. 10.55 and 10.58 p. m., S. F., Cal.—T. T. "No shock so severe as this in S. F. since February 15, 1856."—B. Ms.

1858. August 19; 22h. 10m.; III.
A light shock in San Francisco.—J. B. T.

1858. September 2; V.
Smart shock at Santa Barbara, Cal.—J. B. T.

1858. September 3; 0h. 40m.; V.
Strong shock at San José and Santa Cruz, Cal.—J. B. T.—Perrey.

1858. September 12; 19h. 40m.; V.
Smart shock at San Francisco, Cal.—J. B. T. Lasting 15 seconds.—Perrey.

1858. September 26; 1h. 26m.
A light shock in San Francisco.—J. B. T.—Perrey.

1858. September ?;
San José and elsewhere. In San José more violent than the shock of January 9, 1857.—B. Ms.—*Sacramento Union*, September 20, 1858.

1858. November 26; 12:35 a. m.; VII.

San Francisco. "A violent earthquake was experienced in the city this morning at twenty-five minutes before one o'clock. It consisted of two shocks, separated by an interval of a few seconds, and lasting altogether about half a minute. It is considered to have been nearly as violent as the great shock of February, 1856, and to have lasted much longer. A great deal of alarm was occasioned in some of the larger structures of the city, particularly in the Montgomery block, and in the Rassette House and other extensive hotels. A number of buildings were vacated temporarily. At Musical Hall, where the Independent National Guard were having a ball, the shock was not noticed on the dancing floor, though the building was very much shaken. In the Merchants' Exchange building, opposite the Custom House, some large cracks were made, and a portion of the cornice in the U. S. District Court-room was shaken down. At the City Hall some small pieces of plastering were shaken off, but no serious injury was done; nor, indeed, have we heard of any damage in the city. At the Union Hotel, adjoining the City Hall, the window-blinds were observed to flap violently against the windows, and it was thought by persons in Merchant Street that the building would fall, so violently was it rocked. In many portions of the city bells were rung and crockery rattled."—B. Ms.—*S. F. Bulletin*, November 26, 1858.

1858. November 26; VIII.

San José. "The earthquake was more severely felt at San José than any that has before occurred there. Every family had dishes, glassware, or clocks broken by falling off the shelves or tables. Almost every grocery store had bottles, etc., thrown off the shelves and broken. Every brick, adobe, or concrete building was cracked or injured in some way, or had the plastering broken off. Some plastering was broken off the City Hall. The Jail and Sheriff's office, a two-story brick building, was damaged considerably by the cracking and falling of the plastering. The new Baptist church had the front walls cracked in several places. A new brick building, only one story high, eighteen by twenty feet in size, and very firmly built, was cracked through the center, and had the plastering shaken off. Mr. Minor's concrete building had two corners and a part of the cornice shaken off, damaging it to the extent of about five hundred dollars. Our informant says: "Mr. J. Lewis' large clock was stopped at just eighteen minutes and twenty-two seconds before one o'clock, which must have been the exact time of the commencement of the trembling. He looked at his watch at the conclusion of the shock, when it was just eighteen minutes to one—which would make the duration of the earthquake just twenty-two seconds, if the watch and clock kept the same time. The undulations were from the north to the south,

accompanied by a rumbling noise."—B. Ms.—*S. F. Bulletin*, November 27, 1858.

1858. November 26; 0:35 a. m.; VII.

Two shocks, San Francisco, Cal.—T. T. 0h. 24m. a heavy shock at San Francisco and Oakland.—J. B. T. Nearly every brick building in San José was injured. The shock at San José was twenty-two seconds long, and began at 0h. 42m.—B. Ms.—Perrey. This shock was not felt at Stockton, Sacramento, nor Marysville.—J. B. T.

N. B.—This shock was a Santa Clara *Valley* earthquake.

1858. December 6; 2 p. m.

Mariposa, Cal.—Perrey.

1859. January 25; 20h. 20m.; VI.

Severe shock in Trinity and Shasta Counties; at Weaverville, Shasta, and Horsetown.—J. B. T.

1859. March 21; 5h. 20m. a. m.

San Diego, Cal.—Perrey.

1859. March 25; VI.

Fourteen shocks, one very severe, at San Felipe, Santa Clara County, Cal.—B. Ms.

1859. March;

Dr. Mogencraft reports an eruption in northern part of Shasta County.—Perrey. [?]

1859. April 4; 13h.; VI.

Severe shock at San José, Cal.—J. B. T.

1859. April 27; 7:30 p. m.

San Francisco, Cal., two shocks.—Perrey.

1859. August 8;

San José.—*Sacramento Union*, August 15, 1859.

1859. August 10; about 9:30 p. m.; V.

Heavy shock at San José; after several minutes another slighter.—B. Ms.—*Sacramento Union*, August 15, 1859.

1859. August 10; 22h. 35m.; V.

Smart shock in S. F.—J. B. T.—S. F. D.

1859. August 15; August 17.

Eruption of Mt. Hood, Oregon.—Perrey. [?]

1859. August 29; 10:30 p. m.

Three distinct shocks in Mariposa County, Cal.—B. Ms.—*Alta*, September 10, 1859.

1859. August;
Big Valley, Lake County, Cal.—B. Ms.—*S. F. Bulletin*, September 3, 1859.—The shocks were not felt a few miles off. (See 1856, December.)

1859. September 9; 9:30 a. m.
Two distinct shocks. Petaluma, Cal.—B. Ms.—*Sacramento Union*, September 15, 1859. Slight shock, S. F., Cal. (IV?).—B. Ms.

1859. September 22; a. m.; VI.
Severe shock, S. F., Cal.—S. F. D.

1859. September 24; 3 a. m.; IV.
Slight shock at Half Moon Bay.—B. Ms.—*Sacramento Union*, September 28, 1859. Waters of the bay receded fifteen feet and returned suddenly.

1859. September 24; 5:45 a. m.
San Francisco, Cal.—T. T.

1859. September 26; 6h. 10m.; V.
Smart shock in San Francisco, Cal.—J. B. T.

1859. October 5; 0:16 p. m.; VII.
Severe shock at San Francisco, Cal.—T. T. 13h. 8m.; strong shock, S. F., Cal.—J. B. T.—Perrey.—The severest since 1856, February 15.

1859. October 18; 6 a. m. (See September 24).
S. F.; at Half Moon Bay the water left the bay for several seconds. —Perrey.

1859. November 19; 3 a. m.; IV.
Slight shock, S. F., Cal.—B. Ms.—*Sacramento Union*, November 22, 1859.

1859. November 22;
Mt. Baker in full activity.—Perrey. [?]

1859. November 25;
San Francisco, Cal.—Perrey.

1859. November 27; evening.
Two shocks, San Francisco, Cal.—Perrey.

1859. November 27; 19h. 15m.; IV.
A light shock in San Francisco, Cal.—J. B. T.

1859. December 1; 0h. 50m.; V.
Smart shock in San Francisco, Cal. Felt at Oakland and Benicia.—J. B. T.—Perrey.

1859. December 1; 14h. 10m.; V.
Several successive shocks were felt at San Bernardino; several of them were quite heavy.—J. B. T. 2.10 p. m.—Perrey.

1859. December 6; evening; IV.
Slight shock at S. F., Cal.—S. F. D.

1859. December 11; 9 a. m.; V.
Smart shock at San José.—B. Ms.—*Sacramento Union*, December 12, 1859.

1859. December 24; 0:54 a. m.
San Francisco, Cal.—T. T.

1859. December;
Eruption of Mt. Baker.—Perrey. [?]

1860. January 1; 8:43 p. m.; III.
Light shock at S. F., Cal.—Perrey.

1860. January 26-27; night.
Los Angeles, Cal.—Perrey.

1860. February 9; a few minutes before 1 o'clock.
S. F., Cal.—B. Ms.—*Sacramento Union*, February 10, 1860.

1860. March 15; 11h.; VII.
Violent shock at Sacramento. The wave passed through the counties of Placer, Nevada, El Dorado, and Plumas. The earthquake extended to the eastern base of the Sierra Nevada. At Carson City it occurred at 10h. 45m. and was very violent.—J. B. T.

1860. March 26; VI.
Los Angeles and Southern California, severe.—B. Ms.

1860. March 27; VI.
Severe shock in Los Angeles and vicinity.—J. B. T.

1860. April 2; 8 p. m.; VI.
Two severe shocks at San Juan, Monterey County, Cal.—B. Ms.—*Sacramento Union*, April 7, 1860.

1860. April 5; 1 a. m.
Several shocks in S. F., Cal.—Perrey.

1860. April 16; 7:30 p. m.
San Francisco, Fort Tejon, Santa Barbara.—B. Ms.—*Sacramento Union*, May 1, 1860.
7 p. m. Severe shocks at S. F., Cal. (VI).—Perrey. April 17? About this time shocks during several hours at Washoe, Nev.—Perrey.

1860. April 19;
Several shocks, S. F., Cal.—Perrey.

1860. April 26;
Eruption of Mt. Baker.—Perrey. [?]

1860. May 7;
Port Townsend, W. T.—Perrey.—P.

1860. May 25; about 6 a. m.
Two shocks at S. F., Cal.—B. Ms.—*Sacramento Union*, May 28, 1860.

1860. June 1; evening.
Mariposa.—B. Ms.—*Sacramento Union*, June 9, 1860.

1860. September 23; 10 a. m.
S. F., Cal.—B. Ms.—*Sacramento Union*, September 26, 1860.

1860. September 23; about 9 p. m.; VI.
Severe shock at Martinez.—B. Ms.—*Alta*, October 1, 1860.

1860. September 30; 10 a. m.
S. F., Cal.—Perrey.

1860. November 12; V.
Smart shock at Humboldt Bay, Cal.—J. B. T. Felt in various parts of the country, also.—B. Ms. *Alta*, November 24, 1860.

1860. November 24; 1:30 a. m.
S. F., Cal.—Perrey.

1860. December 21; 6h. 30m.; I?
Repeated slight vibrations, extending over a period of half an hour, noticeable only by the vibrations of the mercury in the barometer. S. F., Cal.—J. B. T. The next day a violent earthquake at Santiago de Chile.—Milne's *Earthquakes*, p. 331. [Probably no connection between these events.]

1861. January 12; about 1 a. m.; VI.
Two severe shocks in Trinity County, Cal.—B. Ms. *Sacramento Union*, January 29, 1861.

1861. January 27; 8 a. m.
Butte County, Cal.—B. Ms. *Sacramento Union*, February 4 and February 12, 1861. (Supposed to be an explosion of gunpowder, or of a meteor, or the rumbling of an avalanche. Heard also in Sierra County.)

1861. February 2; 1:30 a. m.
San Francisco, Cal.—Perrey.

1861. March 23; ? a. m.; V.
Quite severe at S. F., Cal.—B. Ms.—*Sacramento Union*, March 25, 1861.

1861. March ?
Tejon, Cal.—B. Ms.

1861. April 29; 4:10 a. m. ? p. m. ? III.
Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, May 2, 1861.

1861. April 29; 9:25 p. m.; V.
Smart shock at Mendocino, Cal.—B. Ms.—*Sacramento Union*, May 11, 1861.

1861. May 4; p. m.; III.
Slight shock in the neighborhood of San Francisco. During this week the tides were unusually low.—Perrey.

1861. June 13; 5:25 a. m.; III.
Slight shock at S. F., Cal.—B. Ms.—*Sacramento Union*, June 15, 1861.

1861. July 2;
Alameda, Cal.—B. Ms.—*Sacramento Union*, July 8, 1861.

1861. July 3; 4:11 p. m.
Severe shock, followed by two light shocks, at San Francisco, Cal.—T. T. For several days light shocks were felt in and near S. F.—J. B. T.

A light shock in San Francisco (IV?), but *very heavy, indeed*, at Doherty's Ranch, in Amador Valley, near where Livermore now is (IX?).—Verbal account of R. C. Hopkins. Adobe houses seriously injured; men in the fields were thrown down.—Hittell's *Resources*, p. 43. Stockton, also.—B. Ms.

1861. July 3; 8 a. m.; July 4 and 5, at night; July 7, at night.
Slight shocks in Alameda, Cal.—B. Ms.—*Sacramento Union*, July 15, 1861.

1861. July 4?; 16h. 11m.
Severe shock of earthquake occurred at San Francisco. It consisted of three distinct waves, following each other in very rapid succession. More severe in the San Ramon Valley, east of the city. It opened a large fissure in the earth, and a new spring of water. For several days after there were light shocks. J. B. T.—Perrey.

1861. September 16; 2 a. m.
Violent earthquake at Sierra Valley, Nevada County, Cal.—B. Ms.—*Sacramento Union*, September 30, 1861.

1861. October 26? November 26?
Humboldt, Cal.—B. Ms. *S. F. Bulletin*, December 2, 1861, gives the date as October 26; *Sacramento Union* gives November 26. The same shock is referred to by both papers.

1861. December 9;
Santa Catalina Island.—B. Ms.

1862. January 21; about 5 a. m.
Stockton.—B. Ms.—*Sacramento Union*, January 25, 1862.

1862. March;
Tejon, Cal.—B. Ms.

1862. May 27; VI.
Severe shock in Southern California, San Diego, Temecula, and Anaheim.—B. Ms.

1862. May 27 to June 5;
Shocks nearly every day.—B. Ms. [In Southern California?? E. S. H.]

1862. June 7;
Los Angeles.—B. Ms.

1862. June 13;
San Diego, Cal.—B. Ms.

1862. June 14;
San Diego, Cal.—B. Ms.

1862. July 2; about 5 p. m.; VI.
A severe shock at La Porte, Sierra County, Cal.—B. Ms.—*S. F. Bulletin*, July 11, 1862.

1862. September 28; 7-8 a. m.
In the *Echo du Pacifique* of October 1 two shocks are reported.—Perrey.

1862. September 29; 15h. 5m.; VI.
A very smart shock at San Francisco. Felt also at Petaluma.—J. B. T.

1862. October 21; VI.
Violent shock at San Diego, Cal. Seven shocks since May 28.—B. Ms.

1862. December 20? 27?; about 5 a. m.
S. F. and Oakland, Cal.—Perrey.

1862. December 23; 20h. 19m.; V.
Smart shock in San Francisco, Cal.—J. B. T. 5.30 a. m.—T. T. Thunder at 2 a. m.—B. Ms.

1862. December 20; III.
Slight shock at San Francisco.—S. F. D.

1863. January 17; about midnight.
S. F., Cal.—Perrey.

1863. January 25; 2h. 20m. p. m.; VI.
A severe shock at San Diego, Cal.—J. B. T.—B. Ms.—*Alta*, February 11, 1863.

1863. January 25; 5h. 20m.; VI.
Severe shock in San Diego, Cal.—J. B. T.

1863. February 1; 16h. 1m.
A very smart shock at the Mission San Juan, Monterey County (V?). At Gilroys, twelve miles east of the Mission, the shock was fifteen minutes later. The shock was not felt at Monterey, twelve miles west of the Mission.—J. B. T.

1863. February 6; 4 p. m.
New Gilroy, twelve miles northwest of San Juan, at 4.15 p. m.; San Juan, Monterey County, 4 p. m.—B. Ms.—*Alta*, February 11, 1863.

1863. March 18; about 2 a. m.; VI.
A severe shock in San Francisco, Cal.—S. F. D. (not noted by T. T. 2 a. m.).

1863. June ?; V.
A smart shock at San Francisco, Cal.—J. B. T.

1863. About June 27; 1:11 p. m.
San Diego.—B. Ms.—*Alta*, July 7, 1863.

1863. July 15; 6:30-8:30?; V.
Two strong shocks at San José, Cal.—Perrey.

1863. July 15; 10h. 19m.; V.
Smart shock in San Francisco, Cal.—J. B. T.

1863. July 16;
San José; Santa Clara.—B. Ms.

1863. July 24; about 10 a. m.; V.
A severe shock at S. F., Cal.—S. F. D.

1863. July 31; about 10 a. m.
Strong shock at S. F., Cal.—Perrey.

1863. August 1; 10h. 48m. p. m., and 11h. 6m. p. m,
Two shocks at San Francisco.—J. B. T.

1863. August 2; 11:15 p. m.; V.
Three severe shocks at S. F., Cal.—S. F. D. (not noted by T. T.).

1863. October 18;
Yuba City, Sutter County, Cal.—B. Ms.—*S. F. Bulletin*, October 22, 1863.

1863. December 19; 2:38 p. m.; VIII?
Severe shock at S. F., Cal., followed a few seconds later by one more severe. Probably the severest shock since 1855.—B. Ms.—[1856?].

1863. December 19; 2:45 p. m.; VII.
Very severe shock at San José and Santa Clara.—B. Ms.—*Alta*, December 20, 1863.

1863. December 23; 2:40 p. m.; V.
Strong shock, 5-6s., in S. F., and San José, Cal.—Perrey.

1863. December 30; about 3 a. m.; V.
Strong shock in S. F., Cal.—Perrey. Several shocks.—S. F. D.

1864. February 26; 0h. 40m., and 2h. 10m., 5h. 47m.; VI.
Shocks in San Francisco, Visalia, San José, and Santa Clara.—J. B. T. Severe at Santa Cruz.—B. Ms. Severe in S. F.—B. Ms.—Perrey. Very severe at Santa Cruz (VI).—Mr. Sawin's Diary.

1864. March 5; 8h. 49m.
A shock of considerable violence at San Francisco, Santa Rosa, Santa Cruz (V), Stockton, Petaluma, Santa Clara (VI), and San José (VI). At the last named place the shock was most violent and lasted about two minutes. Very severe at Visalia (VI).—J. B. T. Light shock at S. F., 8.50 a. m.—T. T.

1864. March 5; V.
Santa Cruz. Door bell rung.—Mr. Sawin's Diary.

1864. 8:30 a. m. (Date?)
Tuolumne, Cal.—B. Ms.—*S. F. Bulletin*, March 10, 1864.

1864. March 10; 14h. 8m.; IV.
A light shock at San Francisco.—J. B. T. 16h. 30m., a second shock.—J. B. T.

1864. March 11; 9:15 a. m.; III.
Slight shock at S. F., Cal.—S. F. D.

1864. March 20; 23h. 45m.; III.
A light shock in San Francisco.—J. B. T.

1864. March 22; 13h.; V.
Smart shock at Stockton, Cal.—J. B. T.—S. F., Santa Clara — Perrey.

1864. May 20; 18h. 1m. [6h. 1m.?]
Slight shock at San Francisco, Cal.; 18h. 10m. severe shock at Stockton (V); 18h. 57m. severe shock at Napa (V); 18h. very severe at Sacramento (VI).—J. B. T.

1864. May 20; 5:56 p. m.
Light shock at San Francisco, Cal.—T. T. Five or six shocks were reported about 6 p. m., *very severe* [?]—*Mining and Scientific Press.* S. F. D.

1864. June 6; 11h. 7m.; III.
A light shock in San Francisco.—J. B. T.

1864. June 22; 20h. 53m.; V.
Smart shock at San Francisco, Cal.—J. B. T.—Perrey.

1864. July 5; 20h. 3m.; IV.
Moderate shock at San Francisco, Cal.; four vibrations.—J. B. T.

1864. July 18; 8h. 20m. p. m.
Near Los Angeles, Cal.—Perrey.

1864. July 21; 2h. 7m.; V.
Smart shock in San Francisco.—J. B. T. Several shocks, July 21.—S. F. D.

1864. July 21; 22h. 40m. 38s.; VI.
A very smart shock in San Francisco, San José, and Stockton; twelve minutes later in Los Angeles, but not very heavy.—J. B. T. *Not felt at Sacramento.*—Perrey.

1864. July 25; 23h. 56m.
Los Angeles, Cal.—J. B. T.

1864. August 1.
San Francisco, San José, Sacramento, Stockton, and Los Angeles. Perrey.

1864. August 15; 9h. 53m. p. m.; V.
Fort Miller, Fresno County, Cal.; strong shocks.—Perrey.

1864. August 17; 22h. 39m.; IV.
A light shock at Nevada, Cal., and vicinity.—J. B. T.—Perrey.

1864. August 18; 5h. 18m.; VI.
Very strong, Grass Valley, Cal., and Nevada.—J. B. T. Marysville, Yuba.—Perrey.

1864. September 6; 10h. 3m.
San Francisco, Cal.—J. B. T.—Perrey.

1864. September 20; 11h. 0m.
San José and S. F., Cal.—J. B. T. 10.45 a. m.—S. F. D.

1864. September 27; 10h. 32m.; V.
Strong shock, Mission San Juan, Monterey County, Cal.—J. B. T. Also at Watsonville.—Perrey.

1864. September 29; 11:20 a. m., ? p. m. ?
San Francisco.—Perrey.

1864. September 30; 10:30 a. m.
San Francisco.—Perrey.

1864. October 6; 21h. 9m.; V.
Smart shock at San Francisco, Cal.—J. B. T.—Perrey.

1864. October 14; 1h. 8m.; V.
Two heavy shocks at Mission San Juan.—J. B. T.

1864. October 14; 10h. 25m.
Heavy shock at Mission San Juan.—J. B. T.

1864. October 18; at night.
San Juan; two shocks.—Perrey.

1864. October 21; 3h. a. m.; V.
Strong shock at San Juan Bautista.—Perrey.

1864. October 27; about 10 p. m.; IV.
San Francisco, Cal. (Several light shocks.)—Perrey.

1864. October 29; night.
Victoria (Vancouver). Severest shock on record [?], lasting fifteen seconds. Felt also at New Westminster.—Perrey. (VI) at Victoria.—P.

1864. December 11; 20h. 52m. [8h. 52m. ?]
At San Francisco and San José; at the last place one minute later and more severe.—J. B. T. 9 p. m.—S. F. D.

1864. December 18; V.
Strong shock at Watsonville, Santa Cruz County, Cal.—Perrey.

1865. January 2;
Ukiah, Mendocino County, Cal.—B. Ms.

1865. January 9; 7h.; V.
Smart shock in Santa Rosa, Sonoma County, Cal.—J. B. T.—Fuchs. Perrey.

1865. January 19; 8h. 8m.; III.
A light shock in San Francisco.—J. B. T.

1865. February 4; 11 p. m.; V.
Strong shock in S. F., Cal.—Fuchs.

1865. February 7; to end of 1866.
It is the opinion of Fuchs (p. 10) that a period of earthquakes in San Francisco began on February 7 and lasted during the whole of the year 1866, and even into 1867. The greatest shock was 1865, October 8.

1865. February 7; 11 p. m.
San Francisco.—Perrey.

1865. February 8; 2 p. m.; V.
Strong shock in S. F., another at 6½ p. m.—Fuchs.

1865. March 5; night.
Petaluma; the heaviest ever felt up to this time.—B. Ms.

1865. March 5; 8h. 45m.; IV.
A light shock at Visalia, Cal.—J. B. T.

1865. March 7; 11½ p. m.; V.
Heavy shock in Napa City, followed one hour later by a lighter one. —Fuchs. Smart shock at San Francisco at 23h. [11h.?]—J. B. T.

1865. March 8; 6 a. m.; V.
Heavy shock at Napa City, and half an hour later another shock. In Santa Rosa, six shocks.—Fuchs. Smart shock in S. F., 6h. 20m. J. B. T.

1865. March 19;
San Francisco.—Perrey.

1865. March 24; 7:30 a. m.; IV;
Rather severe shock in S. F., Cal.—Fuchs.

1865. March 30; 7h. 28m.; V.
Very smart shock at San Francisco, Cal.—J. B. T.—Perrey.

1865. April 15; 0h. 40m.; VI.
Severe shock at San Diego, Cal.—J. B. T.

1865. April 18; 13h. 31m.; IV and V.
Light shock at San Francisco, Angel Island, and Oakland (IV). Severe at San Juan, Monterey County (V).—J. B. T.

1865. April 26; 3:55 p. m.; V.
Quite a severe shock in S. F.—*Mining and Scientific Press.* Heavy shocks in many places in California, all from E. to W.—Fuchs.—Perrey. Two shocks, S. F., Cal.—S. F. D.

1865. April 27; 15h. 56m.
Shock at San Francisco, Cal.—J. B. T.

1865. May 24; 3h. 21m.; V.
Smart shock at San Francisco, San Juan, and Santa Cruz. At the first place, a single movement; at the second, two waves.—J. B. T. —Perrey.—Fuchs. Light shock at 3.30 a. m.—T. T. Remarkably heavy in Southern California (VII?).—B. Ms.

1865. June 12; ?
Several shocks at Victoria, Vancouver Island.—Fuchs.—P.

1865. June 14; 12m.; III.
Slight shock at S. F., Cal.—S. F. D.

1865. August 25; 9 p. m.; VI.
Heavy shock at Vancouver Island, lasting two minutes; later two more shocks.—Fuchs. (IV) at Victoria.—P.

1865. August 29; 5 a. m.
Shock in S. F., Cal., from southeast to northwest.—Fuchs.—Perrey.

1865. September 21;
Eruption at Mt. Hood.—Perrey. (Doubtful.)

1865. September 22; V.
Smart shock at Yreka, Cal.—J. B. T.

1865. September 23;
Mt. Hood in eruption from September 23 to October 8, certainly.—B. Ms. [?]

1865. October 1; 7 a. m.; IX.
Heavy shock at Eureka, Cal.—Fuchs. Which destroyed all the brick houses.—Perrey.

1865. October 1; 9h. 15m.; VI or more severe.
Very smart shock at Fort Humboldt, Cal.—J. B. T.

1865. October 3; V.
Heavy shock at Eureka, Humboldt County, Cal.—B. Ms.

1865. October 5; ?
Shock in S. F., Cal.—Fuchs.—Perrey.

1865. October 8; 12h. 46m.
Very severe shock at San Francisco, San José, Stockton, Santa Cruz, Sacramento, etc. Most severe shock since the annexation of the territory, and it was followed by a condition of continuous vibration, which lasted for about ten hours. J. B. T.—T. T. Yolo County.—B. Ms.

1865. October 8; 22h. 1m.

Light shock at San Francisco, San José, Stockton, Santa Cruz, Sacramento, etc.—J. B. T. Another at 23h. 50m.—J. B. T.

1865. October 8; IX; (Sunday).

San Francisco. The first shock was felt at sixteen minutes before one o'clock p. m., and lasted perhaps five seconds. It was almost instantly followed by a heavier shock, which continued for ten seconds or more. The vibrations appeared to be east and west, or northeast and southwest. There was nothing in the weather or in the condition of the atmosphere during the previous week to foretell the earthquake. On October 8, in the evening, there were two or three slight additional shocks. The chief damages to buildings were to Popper's building, Third and Mission streets, the City Hall, the old Merchants' Exchange, corner Battery and Washington streets. The latter building was completely ruined. The California Engine Company's House, Market and Sansome streets, was severely injured and rendered unfit for occupancy. The chimney in the rear of the Lick House was shaken down. Stoddard's warehouse on Beale Street is said to have been thrown out of place several inches. On Third Street, from Market to Howard, the window glass was broken in many places. On Washington Street, also, the glass appears to have suffered from Dupont Street down to Montgomery. On the marshy lands in the vicinity of Howard and Seventh streets, lamp posts, water pipes and gas pipes were broken and thrown out of position. The ground on Howard Street, from Seventh north to Ninth, cracked open, leaving a fissure nearly an inch wide. Not one fatal accident has yet been heard of. The effect of the earthquake on the waters of Mission Bay and on Long Bridge was frightful. The shock was felt severely at San José. About ten feet of the wall of the jail was thrown down, and a portion of the wall of the Methodist church. The bell of the convent was tolled. At Santa Clara nearly all of the brick buildings in town were more or less injured. On the Santa Cruz Gap road chimneys were thrown down and the roads more or less obstructed by stones rolled down from the mountains. At Stockton the shock was very severe. At Visalia and Los Angeles the earthquake was not felt at all.—B. Ms.—*S. F. Bulletin*, October 9, 1865. A friend walking on W. side of Montgomery Street, S. F., near Bush, did not feel the shock at all.—E. S. H.

1865, October 8. The shock at Sacramento did no damage, although it was severe enough to cause many persons to feel nausea (VII). —B. Ms.—*S. F. Bulletin*, October 11, 1865.

1865, October 8. This shock was not felt in the slightest degree at Santa Barbara—at least not in the vicinity of the town.—B. Ms.—*S. F. Bulletin*, October 17, 1865.

1865, October 8. At New Almaden a large brick storehouse on the hill was nearly demolished. Several houses in the village were thrown down. The earth opened and closed again, throwing up great clouds of dust. Two miles out of San José, on the road to New Almaden, the new brick building of Mr. John W. Winters was materially damaged. A number of chimneys in different parts of the county were thrown down.—B. Ms.—*San José Patriot*, October 11; quoted in *S. F. Bulletin*, October 12, 1865.

1865, October 8. "The streams at McCartysville and Los Gatos have risen greatly since the earthquake, tapping the sources of the artesian wells in the Santa Clara Valley, many of which have ceased to run since the earthquake."—B. Ms.—*S. F. Bulletin*, October 31, 1865.

1865, October 8. At Mountain Charley's, on the Santa Cruz road, the earth opened in several places, and steam and water were thrown up through the cracks. At McCartysville or Saratoga the creek began to rise four hours after the great shock, and increased to about treble the usual quantity of water the creek discharges during the dry season.—B. Ms.—*S. F. Bulletin*, October 21, 1865.

1865. October 8; VIII.

At Fort Humboldt, on Sunday morning, October 8, 1865, at fifteen minutes past nine o'clock, there was a very severe earthquake. Fifteen chimneys will have to be completely rebuilt.—*S. F. Bulletin*, October 12, 1865.

1865. October 8; VIII or more severe.

Goose Lake, Siskiyou County, Cal. Waterspouts observed all over Goose Lake.—B. Ms.—*Yreka Union*, October 28, 1865.

1865. October 8;

Accounts given in Bancroft's Ms. as follows: *San Francisco Bulletin*, October 9, 12, 1865. *San Francisco Call*, October 10. *Gold Hill News*, October 12. *Sacramento Union*, October 10. Hittell's History of San Francisco, p. 354. Shocks felt at Petaluma, but no damage done (VII). *Petaluma Journal and Argus*, October 12. *San Francisco News Letter*, October 14. *S. F. Golden Era*, October 15. (Two articles), *S. F. Californian*, October 14. (In the interior), *S. F. Alta*, October 10, 11, 14, 16 and 17. *S. F. Alta*, October 9 and 10.

1865. October 8;

From Rowlandson the following is extracted: The shock was certainly felt one hundred miles north of S. F. and one hundred miles east. There is no report of any shock south of Monterey Bay. It is a singular fact that the shock was most severe at Santa

Cruz and along the lower part of the Pajaro River (IX). The center of disturbance was probably at the mouth of this river. Mt. Hood was in eruption, and Goose Lake was covered with waterspouts, and Rowlandson connects these with the S. F. disturbance. There was no shock felt at any distance from the coast, but boats a few miles from shore felt the shock.

1865. October 9; 10h. 34m.; IV.
Light shock in San Francisco, Cal.—J. B. T.

1865. October 9; 11h. 32m.; IV.
Light shock at San Francisco. After this shock the earth continued to vibrate for forty-eight hours.—J. B. T.

1865. October 12; 12:45 a. m.
S. F., and Santa Clara, Cal.—B. Ms.—*S. F. Bulletin*, October 13, 1865. Constant tremors in San Francisco.—Fuchs. This Santa Clara shock is stated to have been as heavy as the one felt between 10 and 11 o'clock, October 8.—See also Perrey.

1865. October 13; 2h. 5m.; V.
Smart shock at San Francisco, Oakland, Santa Clara, and Angel Island, Cal.—J. B. T.

1865. October 14, 15, 16; night and day.
Monterey—many shocks.—B. Ms.

1865. October 14; 23h. 45m.
San Francisco, Cal.—J. B. T.

1865. October 15; 3h. 40m.
San Francisco, Cal.—J. B. T. Santa Cruz; Santa Clara.—B. Ms.—Perrey.

1865. October 20; 7:55 p. m.
S. F., Cal.—Fuchs.—Perrey.

1865. October 27; 1 a. m.
Napa City, Cal.—Fuchs.

1865. November 24; 3:45 a. m.
Shocks in S. F. and in Santa Cruz County, Cal.—Fuchs. Smart shock at Watsonville, Santa Cruz County (V).—J. B. T.

1865. November 26; ?
At sea, between S. F. and Portland, an earthquake.—*Mining and Scientific Press.*

1865. December 7; 1h. 15m.; IV.
Light shock in San Francisco.—J. B. T.

1865. December 15; 9 p. m.; VII.
Heavy shock at Dry Creek, Mendocino County, Cal.; nine shocks, three being quite heavy.—*Mining and Scientific Press.*

1866. January 25; 10:32 a. m.
Slight shock in S. F., Cal. (IV). At 10h. 10m., heavy shock in Sonoma (V).—Fuchs. Another smart shock in S. F. at 10.40 (V). —Perrey.

1866. February 15; 8:45 a. m.
Slight shock in San José, Cal., followed at 9.10 by a shock covering a greater area.—Fuchs. At 8.57 a. m. two shocks at S. F., Cal.—B. Ms. Two shocks at Santa Clara.—Perrey.

1866. February 17; IX.
"The Klamath River, fifteen miles above the Jacksonville road, was suddenly raised, exposing its bed, while a hill on its bank sunk away to a level plain; on one side of the hill, where it separated from the mainland, it left an abrupt bluff. The river channel was immediately changed, the water running around where the hill had been standing. Bob Whittle and others witnessed the phenomenon, and gathered large quantities of fish that were left in the old bed when the water drained off."—B. Ms.—*Quincy Union*, March 10, 1866.—*Yreka Journal.*

1866. February 18; 4:05 p. m.
S. F., Cal.—Fuchs.—Perrey.

1866. March 26; 12:30 p. m.; IV.
Earthquake from east to west, in S. F., Stockton, Sacramento, San José, etc.—Fuchs. Two shocks.—S. F. D.

1866. March 26; V.
Quite a severe shock at Monterey.—B. Ms.

1866. March 26; 12:12 p. m. (noon); III.
Two slight shocks at S. F.—B. Ms.

1866. March 27;
Monterey.—B. Ms.

1866. March ?;
Monterey, Cal.—B. Ms.—*S. F. Golden Era*, March 25, 1866.

1866. April to November;
San José, Cal. An earthquake register, invented by W. F. Stewart, has noted nine distinct shocks in the past seven months. All the shocks were northeast and southwest.—*San José Mercury*, November 8, 1866.

1866. May 24; 9:05 a. m.
Sacramento.—B. Ms.

1866. May 27;
Pacheco, Contra Costa County, Cal.—B. Ms.

1866. May 30; 3:40 a. m.; V.
Heavy shock in S. F., Cal.—Fuchs. Also in Oakland.—B. Ms.—Perrey.

1866. June 5; 6:04 a. m.; IV or more severe.
Rather heavy shock at S. F., Cal.—Fuchs.—Perrey. Seven shocks.—B. Ms. About 4 a. m.—S. F. D.

1866. June;
Monterey, Cal.—B. Ms.—*S. F. Golden Era*, July 1, 1866.

1866. June;
? —B. Ms.—*Gold Hill News*, June 2, 1866.

1866. July 13; 11 p. m.
S. F., and interior towns.—S. F. D. [Probably same? as July 14.—E. S. H.]

1866. July 14; 10:30 p. m.; V.
Heavy shock in La Porte, Rowland Flat, St. Louis, and Port Wine, Sierra County, Cal.—Fuchs. Also Sacramento and Contra Costa County.—B. Ms. Also in S. F.—B. Ms. Heavy in Sacramento; light in S. F. and Stockton (IV).—Perrey.

1866. August 19; 12:40 a. m.
Shock in Oakland and San Francisco.—*Mining and Scientific Press.*

1866. August 23; 4 p. m.
S. F., Cal.—B. Ms.

1866. During the summer; V.
A severe sudden shock at Sulphur Bank, Clear Lake, Cal.—Verbal account of R. S. Floyd, Esq.

1866. September 5; morning.
La Porte, Rowland Flat, St. Louis, and Port Wine, Sierra County, Cal.—B. Ms. Perrey says 5 a. m.

1866. September 6;
Two shocks at S. F., Cal.—S. F. D.

1866. November;
San José, Cal.—B. Ms.—*S. F. Golden Era*, November 18, 1866.

1866. December; III.
Dalles, Oregon.—P.

1866. December 17; night.
Antioch, Contra Costa County, Cal.—B. Ms.

1866. December 18;
Pacheco, Contra Costa County, Cal.—B. Ms.

1866. December 19; 2:20 a. m.
Subterranean noises, accompanied by shocks, in San Francisco and Sacramento, Cal.—Fuchs.—Perrey. 3 a. m.—S. F. D.

1866. December 20; 4:15 p. m.
Antioch, Contra Costa County, Cal. Also a shock in the morning. B. Ms.

1866. December ?
A smart shock at the Dalles, Oregon.—*Mining and Scientific Press*, Vol. 14, p. 46.

1867. January 8; daylight. [?] **X.**
Frightful earthquake at Fort Klamath, Oregon; the Klamath Lake fell six feet.—Fuchs. Two shocks, the second frightful. The air grew dark, ashes fell as thickly a snow in a storm.—B. Ms.—P. gives VIII (??).

EARTHQUAKE AT FORT KLAMATH.—The following letter is to the Oregon *Sentinel*, from Fort Klamath, dated January 8, 1867: Editor *Sentinel:* We have singular, if not serious news, to send by the express just leaving. This morning at daylight we were startled from our sleep by the precipitate shock of an earthquake, immediately followed by a noise as of distant thunder. But in a little while quiet reigned, and every one was conversing and laughing heartily at the singular phenomenon; but our countenances soon underwent a serious change, for it began to grow dark; the whole heavens were full of a very black smoke or cloud; the air had a sulphurous smell; and ashes of a brownish color fell as fast as I ever saw it snow. We had to use candles in the mess-room. Most of us went into breakfast, but had only got fairly into our seats, when, horror upon horror, the earth seemed rolling like waves upon the ocean; every one was thrown to the floor, only, on regaining their feet, to be placed in the same position again, accompanied with the rattling of dishes, the crashing of window glass, cracking of timber of buildings, and the screams of the frightened. You could not imagine a more perfect chaos. Some of us gained the door, and such a sight met our gaze as was probably never before beheld. The tall pines around the fort seemed lashing themselves into fury; the wagons in front of the

stable were engaged in a pitched battle; horses and cattle were lying crouched upon the ground, uttering the most pitiful moans; dogs were howling, and the unearthly cries of the Klamath Indians camped near the fort, completed the scene. The sutler's store was thrown about ninety feet from its former position. There were no lives lost, nor any serious accidents to any one. There is no very serious damage done to any of the buildings, all being log and frame houses, but I do not think there is a whole pane of glass left at the post. Most of us are of opinion that a volcano has broken loose near the Klamath marsh, as a continuous dark column of smoke is seen in that direction. There was but half an hour between the first and second shocks. The first was just perceptible. The second lasted, as near as can be judged from various opinions, from two to three minutes. Further particulars will be given by the next express.

L. TENNYSON, Quartermaster's Clerk.

Mr. Whitmore has just arrived from the agency, and reports that the lake (Klamath) has lowered about six feet, and is still falling. Crooked Creek, a stream between this place and the agency, is completely dried up.—B. Ms.—*S. F. Bulletin*, January 14, 1867.

1867. February 1; ?
Three shocks in San Diego, Cal.—Fuchs.—Perrey.

1867. April 12; 4:50 p. m.
Two shocks in San Francisco.—Fuchs.—Perrey says 5.50 p. m.

1867. August;
Lower Yukon, Alaska.—P.

1867. September 22; 5:35 p. m.
San Francisco, Cal.—Fuchs.

1867. November 30; VI.
Quincy, Plumas County, Cal. Severe shock.—B. Ms.

1867. December 1; 11:12 p. m.
Forest City, Cal.—Fuchs.—Perrey also. Nevada City, very heavy (VII).—B. Ms.

1868. January 2; 9 p. m.
Lake County.—B. Ms.—*Yolo County Hist.*, pp. 56-7.

1868. March 24; 11:22 a. m.; V.
Sharp shock, San Francisco, Cal.—*Mining and Scientific Press.* At 11.22 a. m., lasted six to ten seconds.—B. Ms.

1868. March 25;
Alameda County, Cal.—B. Ms.—*S. F. Bulletin*, March 26.

1868. March 28; about 11 p. m.
S. F., Cal.—S. F. D.

1868. March 29; about 9 p. m.
S. F., Cal.—S. F. D.

1868. About April 23;
Healdsburg, Cal.—*S. F. Bulletin*, May 7, 1868.

1868. April 29; 7:15 a. m.
Three distinct shocks, no damage done, Yreka, Cal.—B. Ms. The first experienced here; it was accompanied by a rumbling noise.—*S. F. Call*, April 30, 1868.

1868. May 7; 12 a. m.; V.
Severe shock at Healdsburg, Cal.—*S. F. Bulletin*, May 7, 1868.

1868. May 9; 11:30 p. m.
Calistoga, Napa County.—B. Ms.—*Alta*, May 11, 1868.

1868. May 18;
Three hundred miles west of San Francisco, in lat. 44° 7′ N. and long. 139° 7′, a submarine earthquake.—Perrey.—*Mém. Cour.* 22, p. 80.

1868. May 24; 9 p. m.
Two shocks in Sacramento, Cal.—Fuchs. Not felt in S. F.; violent in the State of Nevada.—Perrey.

1868. May 26; 10:37 p. m.
San Francisco, Cal.—Fuchs.—Perrey. Two shocks.—B. Ms.

1868. May 27; about 2 a. m.; IV.
S. F., Cal., light shock.—B. Ms.

1868. May 29; 9 p. m.
Three shocks, Lassen County, Cal.; first at 9 p. m.; two others in the course of fifteen minutes.—B. Ms.—*S. F. Bulletin*, June 12, 1868. About 9 p. m., series of shocks in interior of California and in Nevada; but not at S. F., nor north of a line from Sacramento to Ft. Churchill; felt in Sacramento.—B. Ms.

1868. May 30;
Severe earthquake at Mukelteo and the Tulalip Reservation, W. T.—*Bulletin*, June 2, 1868.—P.

1868. May; IX?
A severe earthquake (not felt in Northern or Central California) opened a long fissure in the earth at Dos Palmas, S. P. R. R.—H. Ms.—Editorial *S. F. Bulletin*, March 29, 1872.

1868. June ?

San Diego? Earthquake wave on Pacific Coast.—B. Ms.—*S. F. Bulletin*, June 13, 1868.

1868. June 2; 9:30 a. m.; VII.

Very severe, Downieville and Forest City.—*S. F. Bulletin*, June 10, 1868.

1868. July 24; III.

Slight shock at S. F., Cal.—*Appleton's Annual Cyclopædia*, 1868.

1868. July 24; 6:30 p. m.; VII.

Severe shock in Tulare County, Cal.—*S. F. Bulletin*, July 25, 1868.

1868. August 2;

Los Angeles (several shocks).—B. Ms.

1868. August 9; about 10 p. m.

S. F., Cal.—S. F. D.

1868. August 13;

The earthquake at Arica, Peru, on this date, produced tidal waves felt all through the Pacific, and registered at S. F. and San Diego. Velocity of the sea-wave 369 (or 348) miles per hour.—J. E. Hilgard in *Amer. Jour. Sci.*, vi. p. 77. Tidal wave sixty feet high in Southern California; San Pedro Bay.—R. A. Proctor, in *Nature*.

1868. August 24;

Santa Cruz, Cal.—*S. F. Bulletin*, September 3, 1868.

1868. August 24; 11:30 a. m.

S. F., Cal.—S. F. D.

1868. August 28; about 1 a. m.

S. F., Cal.—S. F. D.

1868. August 31; VI or more severe.

Severe shock at Santa Cruz, Cal., lasting ten or fifteen seconds.—B. Ms.

1868. August-September 28;

It is the opinion of Fuchs (p. 10) that a period of earthquakes in the Sierra Nevadas began early in August, 1868. On September 4, 5, 6, there was a great earthquake with more than five hundred shocks, and the period lasted till September 28.

1868. September 3-28; IX.

"Kern River, Inyo County, Cal., September 3, during the night frequent rumbling noises and tremulous motion of the earth. September 4, 8 a. m., severe shock; from 8 to 9 a. m., forty-one dis-

tinct shocks. During the remainder of the day the shocks continued at intervals of five to ten minutes: light shocks continued until the morning of the 6th of September, when the party moved their camp. Up to this time there had been about five hundred shocks. September 6-11, one or two shocks every hour. September 17, 18, 19, about one shock every hour. September 20, 21, 22, much more frequent and severe; then the frequency and violence abated, but continued at intervals of an hour or so up to the time they left on the 28th of September."—J. E. Clayton, M. E., in *Proceedings of the California Academy of Sciences*, vol. IV, part 1. See also Perrey.—*Mém. Cour.* 23, p. 64.

1868. September 3, etc.;

Not felt at Independence, Inyo County.—B. Ms.

1868. September 13, 14, 15;

A correspondent of the *Sacramento Union*, writing from Owens Lake, gives an interesting account of a succession of earthquakes that took place in that region, among the mountains, on the 13, 14, 15 of September. The shocks were severe enough to rattle down rocks from the mountains into the valleys and to excite great alarm among the few inhabitants. About the same time there was an earthquake in Alpine County which was quite severe, showing that the commotion must have extended over hundreds of miles.—*Proceedings of the California Academy of Sciences.*

1868. September 4-17;

Inyo County, Cal., September 4, two shocks; forty shocks in one hour at Lone Pine; September 12, one shock; September 14, two shocks; September 17, one shock; September 11-12, three hundred shocks; the sky was very full of smoke.—B. Ms.

1868. September 17;

Two shocks at Nevada City, Cal.—B. Ms.

1868. September 19; 9 a. m.

Two heavy shocks at Alpine, Cal. The air became dark, and mountains one-half mile distant could not be seen. A 5 p. m. other shocks.—B. Ms.

1868. September 26; 12:40 a. m.; VIII.

Ukiah, Mendocino County, Cal., severe shock; tumbling furniture about.—B. Ms.

1868. October;

Near head of Kern River. [*S. F. Bulletin*, October 17, 1868, says: "There is quite a phenomenon on the Sierra Nevadas, at the head of Kern River. The earth has been shaking for more than two weeks—almost a constant shake. It shakes the rocks down from the mountain, and makes the earth wave like the sea." * * *]

1868. October 3; 12:40 a. m.

Very severe shock in Ukiah Valley, Cal.—B. Ms.—*Alta*, October 7, 1868.

1868. October 6;

Silver Mountain, Cal.—*Appleton's Annual Cyclopædia*, 1868.—Perrey.

1868. October 21; IX.

The great earthquake at San Francisco, Cal. The first shock was at 7h. 53½m. a. m. Its direction was northerly and southerly [more correctly S. 30° W. to N. 30° E.—J. R. J.]. Its duration was forty-two seconds. The second shock came at 9.23 a. m., lasting five seconds. Lighter and briefer tremors occurred at intervals of about half an hour, till 12.15 p. m. The first shock was most severely felt on the eastern side of the city, on the made land between Montgomery Street and the bay. On the solid land no serious damage was done to any well constructed house. Window panes were broken, chimneys twisted or thrown down, mantel ornaments overturned, etc. Steeples swayed to and fro. On Russian and Telegraph Hills the shock was comparatively light. On the flat between Howard Street and the Mission the shock was most severe. The Custom House was badly damaged. It was poorly constructed. Coffee & Risdon's building (corner of Market and Battery streets) was of brick, three stories high, and unfinished. The walls of a portion of this fell, killing a man. The machines in the Union Foundry (First and Mission streets) were put out of order. Several buildings in this neighborhood were more or less wrecked. The tall chimney of the San Francisco Gas Works (Howard and Fremont streets) was thrown down. The Mission Woolen Mills were damaged badly. As in 1865, a small crevasse was opened on Howard Street, beyond Sixth. The Deaf, Dumb and Blind Institution was damaged. The greatest damage was done in a belt several hundred feet wide, running northwest and southeast, commencing at the Custom House and ending at the Folsom Street wharf. The tall chimney of the United States Mint was damaged. The ferry steamer *Contra Costa* was near Angel Island and felt the shock strongly. Shocks were noted at 7.53; 8.10; 8.15; 8.30; 8.45; 9.20; 9.35; 10; 10.30; 11.05 a. m., and at 12.15 and 2.58 p. m. [the 10.30 shock was *vertical* at Pine and Mason streets.—J. R. J.]. Cliff House, S. F.; an unusual commotion in the sea, and the waves came fifteen or twenty feet further inland than usual. There were about thirty casualties in the 150,000 inhabitants. Five deaths occurred from falling walls, etc. Not a single well-built house on the solid land suffered materially, whether of brick, stone, or wood. Wooden houses suffered least. —H. Ms. Also derived from S. F. daily papers of the few days immediately following the shock. See Rowlandson, *et seq.* No register of this shock on the tide-gauges at San Diego and Fort Point.

Oakland. At the beginning, a roaring sound like artillery crossing a bridge was heard coming from the Mission towards Pine and Mason streets, S. F.—J. R. J. The draw of the railroad bridge was thrown twelve inches out of line. The water of the bay was smooth and no wave was noticed due to the shock. Buildings and chimneys fell to the south (IX).

Martinez. The earthquake was heavy at 7.57 a. m. The Court House was wrecked (IX).

Alameda. Several buildings badly damaged (IX).

San Leandro. Several buildings badly damaged; one man killed (IX).

Alvarado. Buildings damaged (IX).

San Lorenzo. Several chimneys thrown down (IX).

Haywards. Very severe; twenty-two shocks during the morning. Not a building that was not damaged, and several wrecked (IX).

Amador Valley. The shock was light (VIII).

Mare Island Navy Yard. Chimneys thrown down. The shock threw down a person who was walking (VIII or IX).

Vallejo. Chimneys thrown down (VIII).

Redwood City. The brick Court House wrecked (IX).

Marysville. Light shock (VII).

Grass Valley. Severe, causing lamps, etc., to vibrate.

Sonora. Slight shock.

San Mateo. Severe, with damage to property.

Placerville. Light shock.

Folsom, Sacramento County. Sharp shock.

At sea. The *Pactolus* was at anchor, in deep water, fifteen miles west of the Heads. The shock was severely felt.

San José. Buildings damaged, chimneys thrown down.

Santa Clara. Buildings damaged, chimneys thrown down.

Gilroy. Chimneys thrown down.

Santa Cruz. Brick buildings cracked.

Healdsburg. Severe; clocks were stopped.

Woodland (Yolo County). Severe.

Centerville. Buildings destroyed and others badly damaged.

Mission San José. Buildings destroyed and others badly damaged.

San Juan. Severe shock.

Sacramento. Severe shock, no damage.

San Rafael. Severe shock, chimneys thrown down.

Petaluma. Buildings damaged, chimneys thrown down.

Santa Rosa. Buildings damaged, chimneys thrown down.

Somerville, Antioch, Clayton. Buildings damaged, chimneys thrown down.

Los Angeles. No shock felt.—H. Ms.

Hon. T. G. Phelps visited the seacoast from Half Moon Bay to Pescadero soon after October 21 and found all chimneys down or twisted (VIII). At Belmont no chimneys overthrown (VII).

1868. October 21; 7:50 a. m.

At 7h. 50m. a. m., after dull rumblings, heavy shocks, lasting 140 seconds, began; six or seven shocks before 11 a. m.; and at 3 p. m. another, and the last about midnight. Earthquakes were felt over all California; the heaviest were the following: Sacramento, 7.59; Oakland, 10.30, 11.45; Marysville, 7.55 and 8 and 1.25 a. m.—Fuchs.

1868, October 21, San Francisco. The shock was longer and more severe than that of October 8, 1865. Several persons were killed by falling cornices. The shock was felt in the interior in every direction, and with severity. The surface of the earth visibly undulated. Brick buildings were tumbled down or badly cracked in several places, including Oakland and San Leandro, and several lives were lost. Not a single thoroughly good building, even in the lower part of the city, was seriously injured.—*S. F. Bulletin*, October 21, 1868. Hon. Horace Davis writes that the destruction in S. F. was greatest along the old beach-line of the city, beyond which the soil had been filled in. Photographs in my possession seem to show that the damage to substantial buildings in S. F. was small.—E. S. H.

1868, October 21, San José. The oscillation was from southeast to northwest and lasted one-half minute. Considerable damage was done to property. No lives were lost. Damage to Presbyterian Church amounted to $2,000.—*San José Advertiser*, October 4, 1868.

1868, October 21. Account of the earthquakes in San Francisco, October 8, 1865, and October 21, 1868.—*San José Pioneer*, February 9, 1878. This earthquake was not felt in San Diego.—B. Ms.

1868, October 21, San Leandro. One man was killed attempting to escape through the falling walls of the Court House, which, with the jail, was laid in ruins. Several concrete buildings were entirely destroyed, and a great many frame buildings partially so. After the earthquake was over, only two chimneys remained standing. The loss was not much short of $100,000. Neighboring towns were severely shocked. Haywards was laid in ruins. But little injury was done at Oakland. It was the most severe shock experienced on the coast by white men up to that time.—*San Leandro Gazette*, October 24, 1868.

1868, October 21, Petaluma. Considerable property destroyed. Vibrations from east to west. Three distinct shocks following

each other in rapid succession, lasting from ten to fifteen seconds. Light shocks for four hours afterwards.—*Petaluma Journal and Argus*, October 22, 1868.

1868, October 21, Sacramento. Severe earthquake. The water of the river receded, and in a short time returned in a wave at least two feet in height.—*Sacramento Bee*, October 21, 1868.

1868, October 21, Santa Cruz Mountains, near Pescadero. Great damage done to the redwood trees. Limbs fell to the ground, and large pieces of rock rolled down the mountains. It is said that the waters of Pescadero Creek became muddy in a moment, and that the surface was covered with bubbles, which burst with a slight report and a small flame when a match was applied to them.—*Grass Valley Union*, October 29, 1868.

1868, October 21. See brief report on the cause and effect, by the committee of merchants in San Francisco Chamber of Commerce report, 1870. See also *Alta*, December 1, 1868.

1868, October 21; about 8 a. m., in San Francisco. Killed five persons by throwing loose bricks from the tops of buildings upon them, and no person was severely injured in a house. The better class of structures was not damaged. A dozen brick buildings, with weak foundations on made ground, were cracked, so as to be untenable.—Hittell, *History of San Francisco*, pp. 370-7. Hon. A. S. Hallidie reports the interesting fact that the air was filled with *horizontal* layers of smoke and dust with layers of clear air between. The appearance was striking.

1868, October 21. Brick and concrete buildings in Pacheco were destroyed. The shocks were severely felt throughout Contra Costa County, except at Antioch. There no chimneys were thrown down, nor were any walls cracked.—*Pacheco, Contra Costa County, Gazette*, October 24, 1868.

1868, October 21. Three heavy and distinct shocks were felt in Nevada City. The most severe known up to this time.—*Nevada City Daily Transcript*, October 22.

1868, October 21. The shock was severe, or very severe, at Martinez, Alameda, Alvarado, San Lorenzo, Haywards, Mare Island, Vallejo, Redwood, Grass Valley (" quite a severe shock "), San Mateo, San José, Gilroy, Santa Cruz, Healdsburg, Woodland (Yolo County), Centerville, Stockton, San Rafael, Petaluma, Santa Rosa, Contra Costa County.—H. Ms. Yolo County.—B. Ms.

1868, October 21. The shock was light at Marysville, Sonora, and Amador Valley.—H. Ms. No shock was felt at Los Angeles, San Diego, etc.—H. Ms. For a complete account of this shock in Alameda County, see Halley, Centennial Book of Alameda County, pp. 257-269. Articles on this earthquake may be found in the following places (from the Bancroft Ms.): *S. F. Times*, October 22,

23, 24, 26, 1868. Telegrams from all parts of the State, in *S. F. Call*, October 22. *S. F. Abend Post*, October 22. Further particulars, loss of life and property, shock in the interior, and estimated damages to buildings and stock.—*S. F. Bulletin*, October 22 and 23. *Alta California*, October 22, 23, and editorial on earthquakes in *Alta*, October 24. Lloyd's *Lights and Shades*, pp. 318 and 324. Earthquake throughout the State; twelve persons killed.—*Sacramento Union*, October 22. *S. F. Bulletin*, October 21, 22, 23, 24, 26, 27, 29. *S. F. Spirit of the Times*, October 24. San Leandro and Haywards. Long article in *Alta* of October 27. *S. F. Call*, October 23. Facts about earthquakes; earthquake in the interior.—*Alta*, October 24, 1868. Open crack in Haywards.—*S. F. Call*, October 25. Report of Earthquake Commission.—*Alta*, December 1, 1868. *S. F. Chronicle*, October 21, 22, 23, 24. Petaluma.—(Oregon) *Deutscher Zeitung*, October 24, 1868. *S. F. Monitor*, October 24. *Cal. Christian Advocate*, October 29. *S. F. Golden Era*, October 24. *S. F. Golden Era*, October 31 (two articles). Grass Valley. Vibrations from southwest to northeast.—*Grass Valley Union*, October 22. *San Leandro Democrat*, October 24, 1868. *Vallejo Weekly Chronicle*, October 31.

Professor Hanks says that a circle with Haywards as a center and 173 miles as radius will cover every point where the vibration was felt. The area of such a circle is 94,000 square miles, or about three-fifths of the area of California.—H. Ms.

Fruitville, Alameda County. Professor Bunnell was walking in a field at the time of the first shock. He heard a loud report, which he referred to the direction of S. F., and immediately felt the earth tremble so violently as to make it difficult to stand upright.

Dr. Gibbons kindly communicates the following record of forty-nine shocks during October and November: October 21; two heavy shocks, twelve light ones (14) during the day, four during the night. October 22; eight day and night. October 23; four till 9 p. m. October 24; three from 6 a. m. to 9 p. m. October 25; three. October 26; two, very heavy. October 27; one. October 28; two. October 29; one. November 3; one, at 7 a. m. November 10; one. November 11; one. November 15; one. November 16; three, or forty-nine in all. Soon after the earthquake of 1868, the feast-day of St. Emidius (August 9) was set apart as a day of prayers for protection against earthquakes by Pope Pius IX on the request of the Archbishop of California.

1868. October 22;

Tremors in S. F., Cal.—Fuchs.—Perrey.

1868. October 23; 2:20 a. m.

Smart shock, San Francisco, Cal.—T. T. Another shock 7.30 a. m.—*Appleton's Annual Cyclopædia*, 1868. 2.15 a. m.; then two light shocks; and another at 7.30 p. m.—Perrey.

1868. October 25;
Tremors in S. F., Cal.—Fuchs. Slight shock at 8 a. m.—S. F. D. A strong shock, very long, at 8.05 a. m.—Perrey.

1868. October 26; about 11 a. m.
Two shocks, San Francisco, Cal.—S. F. D.

1868. October 26; 11:54 p. m.; V.
Smart shock, San Francisco, Cal.—T. T. Also in Oakland.—Fuchs.—Perrey.

1868. October 27; V.
Heavy shock in Oakland, Cal.—Fuchs. S. F.—Perrey.

1868. October 30; 10:20 p. m.; IV.
Slight shock, San Francisco, Cal.—T. T.

1868. October 31;
S. F., Cal.—B. Ms.

1868. November 1; 6:32 p. m.; IV.
Slight shock, San Francisco, Cal.—T. T. Petaluma, Cal.—B. Ms.

1868. November 4; 8:58 p. m.; V.
Smart shock, San Francisco, Cal.—T. T. Two "pretty severe" shocks at Monterey.—B. Ms.

1868. November 5; V.
Heavy shocks in S. F., Cal.—Fuchs. On this day also at Victoria, Vancouver.—Perrey.

1868. November 17; 1:30 p. m.; VI.
Quick and violent shock at Santa Cruz.—*Santa Cruz Times*, November 20, 1868. Quoted in *S. F. Bulletin*, December 1.—B. Ms. *S. F. Call*, December 1, 1868.

1868. November 20;
San Francisco.—Perrey.

1868. November 30;
Several shocks in Oakland, Cal.—B. Ms. *S. F. Bulletin*, December 1.

1868. December 26;
Two shocks at Nevada City, Cal.—B. Ms.

1868. December 31; 11:56 a. m.; III.
Two slight shocks at S. F., Cal.—B. Ms.—*S. F. Times*, January 1, 1869.

1869. January 7; V.
Two sharp shocks near the Newton Copper Mine, Amador? County, Cal.—B. Ms.—(Jackson) *Amador County Ledger*, January 9, 1869.

1869. January 22; about 4 a. m.

At Haywards, Alameda County.—B. Ms.—*S. F. Herald*, January 23, 1869.

1869. January 28; IV.

Slight shock in S. F., Cal.—Fuchs.—Perrey. 4 a. m., shock in S. F., and Santa Cruz Mts.—B. Ms.—*S. F. Times*, January 30, 1869.

1869. January 29; 12 m.; IV.

Slight shock in S. F., Cal.—Fuchs.—Perrey. No notice of this shock in Mr. Sawin's Diary, Santa Cruz.

1869. January 29; 1:45 p. m.; V.

Heavy shock at Watsonville, Santa Cruz County.—B. Ms.—*S. F. Times*, January 30, 1869.

1869. February 1; 10 p. m.; IV.

Slight shock at Livermore, Alameda County, Cal.—B. Ms.—*S. F. Herald*, February 3, 1869.

1869. February 10;

San José, Cal.—Fuchs.—Perrey. Santa Clara.—B. Ms. Submarine earthquake recorded by the tide-gauge at Fort Point, S. F.—*Mining and Scientific Press.*

1869. February 13; 4:30 a. m.; IV.

Light shock in S. F., Cal.—Fuchs.—Perrey. 4 a. m.—S. F. D.

1869. March 11; 9:45 p. m.

San José, Santa Clara County, Cal.—B. Ms.—*S. F. Times*, March 16, 1869.

1869. April 1; 5:47 p. m.; V.

Smart shock, San Francisco, Cal.—T. T. Also in San José, Petaluma, and Stockton.—Fuchs.—Perrey. Lasted eighteen seconds in S. F.; occurred at 5.55 p. m. at Stockton, at Napa City, and Sonoma.—B. Ms.

1869. April ?;

Tuolumne County, Cal.—B. Ms.—*S. F. Times*, April 17, 1869. [The above is the reference in B. Ms., but an examination of this paper failed to find the item.]

1869. May 19; 11:20 a. m.; III.

A slight shock at S. F., Cal.—B. Ms.—*S. F. Times*, May 20, 1869.

1869. May 30; 10:37 a. m.

S. F., Cal.—B. Ms.—*S. F. Times*, May 31, 1869.

1869. June 1;

Earthquake sea waves recorded at Ft. Point (S. F.).—*Mining and Scientific Press.*

1869. June 2;
Santa Cruz and Gilroy papers speak of recent earthquakes, and the Fort Point tide-gauge recorded an earthquake wave.—*Mining and Scientific Press.*

1869. June 12; 9:15 p. m.; V.
Sharp shock at Eureka, Humboldt County, Cal.—B. Ms.—*S. F. Times,* June 29, 1869.

1869. June 25; 6:20 a. m.
S. F. and San José, Cal.—B. Ms.—*S. F. Times,* June 26, 1869.

1869. July 23; 2:28 p. m.
Sharp shock at San Juan, Monterey County.—B. Ms.—*S. F. Times,* August 3, 1869.

1869. July 24;
Shock at San Juan, Monterey County.—B. Ms.—*S. F. Times,* August 3, 1869.

1869. September 5;
Arizona, California [*sic*].—Perrey, *Mém. Cour.* 22, p. 80.

1869. September 12;
?, California.—Fuchs.—Perrey.

1869. September 13;
— California.—Fuchs. Nevada City, Cal.—B. Ms. On the coast, a light shock; heavy at San Luis Obispo (V?); light at Sacramento (IV?).—Perrey.

1869. September 14;
Heavy shock in San Luis Obispo, Cal.—Fuchs.—[See September 13, Perrey's note.—E. S. H.]

1869. September 15;
Light shock in Sacramento, Cal.—Fuchs.

1869. October 6; midnight.
At sea, fifty miles from Mendocino, Cal.—B. Ms.—*S. F. Times,* October 7, 1869.

1869. October 7; at night; V or more severe.
Severe shock at San Bernardino, Cal.—B. Ms.—*S. F. Times,* October 16, 1869; also October 19, 1869.

1869. October 8; 1:30 a. m.; VIII.
Severest shock ever felt at Ukiah Valley, Mendocino County, Cal.—B. Ms.—*S. F. Times,* October 14, 1869. (See 1868, Sept. 26.—E. S. H.)

1869. October 21;
New River Station (near San Diego?).—B. Ms.

1869. October;
Los Angeles.—B. Ms.

1869. December 14; morning.
Santa Cruz, Cal.—B. Ms.—*S. F. Golden Era*, December 19, 1869.

1869. December 15; V.
Heavy shock in San Luis Obispo, Cal.—Fuchs.—Perrey.

1869. December 19; p. m.
Several shocks in Mariposa, Cal., and in the mines of Virginia City, Nevada. Also a. m. December 20.—Fuchs. In the a. m. several shocks at Mariposa.—Perrey.

1869. December 20; 8 p. m.; V.
Strong shock in Grass Valley, Cal.; slightly felt at Sacramento (IV?). —Fuchs.—Perrey. At Ophir Hill also.—B. Ms.

1869. December 26; 5½ p. m.
Three shocks in Marysville; others in Stockton, etc. In Sacramento, two shocks in the daytime; at 9 p. m., another shock here, and at Grass Valley, etc. Twenty-six shocks at Mariposa during this night.—Fuchs. Nevada City and Grass Valley.—B. Ms.

Mokelumne Hill, Calaveras County, Cal. A house near Railroad Flat (VIII?) was lifted bodily several times.—B. Ms. Lowe Hill; Stockton 5.52 p. m.; Truckee; Grass Valley; Nevada; Chico; Mariposa.—Perrey. Nevada City.—B. Ms.

1869. December 27;
This day was the maximum for the California earthquakes of this month; 2 a. m., very heavy shocks in Marysville (VIII); 2.10 a. m., houses thrown down in Sacramento, etc. (IX).—Fuchs.

1869. December 27; 2 a. m.
Marysville, Sacramento, 2 a. m.—Perrey.

1870?
Puget Sound (VII). "Several old settlers insist that there were severe shocks, but none can state the day or time. They may refer to 1872?"—P.

1870. January ?; "end of January."
San Francisco, Cal.—Fuchs.

1870. January 3;
San Bernardino, Los Angeles.—B. Ms.—*S. F. Abend-Post*, January 6, 1870.

1870. January 3; 11 p. m.; V.
"Quite a shock," Bakersfield, Kern County, Cal.—*S. F. Bulletin*, January 6, 1870.—Fuchs.

1870. February 4; IV.
Light shock in S. F., Cal.—Fuchs.

1870. February 13-14; night; IV.
Two light shocks in S. F., Cal.—Fuchs. Oakland, Petaluma.—B. Ms.

1870. February 17; 12h. 12m. 22s. p. m.
Two smart shocks at San Francisco, Cal. (V).—T. T. Also in Petaluma, Sacramento, and San José.—Fuchs. Vallejo, Santa Rosa, Santa Cruz, San Rafael.—B. Ms. Light shock at Monterey (III? IV?).—Fuchs.

1870. March 4;
Grass Valley, Cal.—B. Ms.

1870. March 11;
Prescott, ? California.—Fuchs. (Arizona??)

1870. April 2; 11:48 a. m.; VI.
Smart shock at San Francisco, Cal.—T. T. Six seconds duration.—Fuchs. Pacheco, Contra Costa County.—B. Ms.—Berkeley; light articles overthrown (VI).—John Le Conte.

1870. April 13; 3:30 a. m.
Two shocks at S. F., Cal. Perhaps another at 2.30 a. m.—B. Ms. (Possibly the times are wrong.—E. S. H.)

1870. April 17;
Cahto, Mendocino County, Cal.—Fuchs.

1870. April 24; no time given; IV.
Slight shock, S. F., Cal.—S. F. D. (See April 25. E. S. H.)

1870. April 25; 10 p. m.; III.
Light shock in S. F., Cal.—Fuchs.

1870. April 26; a. m.; III.
Light shock in S. F., Cal.—Fuchs.

1870. April;
San Bernardino.—B. Ms.

1870. May 4;
Grass Valley, Cal.—B. Ms.

1870. May 8;
Gilroy.—B. Ms.

1870. May 12;
Gilroy.—B. Ms.

1870. August 6; 11:20 p. m.: V.
Heavy shock in Ukiah.—Fuchs.

1870. August 9; midnight; V.
Mendocino; duration 10 seconds.—B. Ms.

1870. September 2; 3 a. m.
Monterey, Cal.—Fuchs.

1870. December 4; 2 a. m.
The bark *Amethyst* felt a severe shock of earthquake 45 miles W. S. W. by compass from Cape Mendocino.—From *Pacific Coast Pilot*, communicated by Professor George Davidson, U. S. C. and G. Survey.

1870.
Moleje, Lower California, five severe shocks during the year.—C. G. R.

1871. February 6; 7:17 a. m.
Two shocks, San Francisco, Cal.; also at San José and Santa Cruz.—*Mining and Scientific Press.*

1871. February 9;
San Francisco, Cal.—S. F. D.

1871. March 2; 1:05½ p. m.
Severest for several years in Eureka, Humboldt County, Cal. (VII?); duration, twenty seconds; another shock twenty-five minutes later; another, 7.30 p. m. This shock was even more severe to the south and east, at Rhonerville, Hydesville, in the same county (VIII).—B. Ms.—*S. F. Call*, March 15, 1871. Chimneys thrown down at Rhonerville and Petrolia (VIII). The oscillations lasted twenty minutes.—Appleton's *Annual Cyclopedia*, 1871.

1871. March 2; VIII.
Light-keeper's house at Mendocino, Cal., injured.—B. Ms.—*S. F. Call*, March 28, 1871.

1871. March 6; III.
Weak shock in Carthago, Inyo County, Cal.—Fuchs.

1871. April 2; 7:49 p. m.; IV.
Shock at San Francisco, Cal.—T. T. Two light shocks.—Fuchs. Also in Contra Costa County.—B. Ms.

1871. April 23; III.
Three light shocks at S. F., Cal.—S. F. D.

1871. May 19;
Shocks in Washington Territory, and on Mt. Raynier. During the whole month shocks on the coast.—Fuchs. Tacoma.—P.

1871. June 6; about 9 p. m.; V or more severe.
Two strong shocks at Bear Valley, California.—Fuchs.

1871. June 21;
Strong earthquakes, Cal.—Fuchs.

1871. July 5; 6:54 a. m.
Visalia, Cal.—Fuchs. Also severe shock at Independence and Swansea, Inyo County (VI?).—B. Ms.

1871. July 11; 7 p. m., a. m. ?
Independence, Inyo County, Cal.—B. Ms.

1871. July 11; 7:30 p. m.; VI.
A shock more severe than that of July 5th, at Swansea, Inyo County, Cal.—B. Ms. Another shock at 12 midnight.—B. Ms.

1871. July 11; 9 p. m.
Bishop's Creek, Inyo County, Cal.—B. Ms. Severe at Owensville (V?).—B. Ms.

1871. July 12; midnight.
Swansea, Inyo County.—B. Ms.

1871. July 12; 12 m.
Bishop's Creek, Inyo County, Cal.—B. Ms. Severe at Owensville (V?).—B. Ms.

1871. July;
Kern County.—*Mining and Scientific Press*, July 22, 1871.

1871. August 25;
Santa Rosa.—B. Ms.

1871. August 31;
Gilroy.—B. Ms.

1871. Early in September;
Castroville, Monterey County.—B. Ms.

1871. September 15; 6:45 a. m.
Gilroy, Cal.—Fuchs.

1871. September 18;
S. F., Cal.—S. F. D.

1871. October 21;
Calistoga.—B. Ms.

1871. October 27;
Temecula, near San Diego, Cal.—B. Ms.

1871. December 12; 2:30 a. m.; V.
Quite severe shock at Humboldt.—B. Ms.—*S. F. Call*, December 24, 1871.

1871. No date;

Twenty shocks during the year, no dates given, at Moleje, Southern California.—Fuchs.

1872. February 6;

Santa Barbara, "the first shock for fifteen years."—B. Ms. [There are shocks recorded, 1857, March 14, 1858, September 2, and 1860, April 16, within the period of fifteen years; but none from 1860 to 1872—twelve years.—E. S. H.]

1872. February 11;

Stockton.—B. Ms.

1872. February;

Fresno County.—B. Ms.

1872. March 17; about 1 o'clock; VIII.

Severe shock at Lone Pine, Cal.—C. G. R. "Frightful."—Fuchs.

1872. March 18;

S. F., Cal.—S. F. D.

1872. March 23;

San Diego.—B. Ms.

1872. March 25; (V?)

Severe shock at Jackson, Amador County, Cal.—B. Ms.

1872. March 26;

Great Inyo County earthquake. Shocks were felt on this day in the City of Mexico, New Madrid, Mo., and many other distant points. —B. Ms. Fuchs does not mention any earthquakes on this day except one on the coast of Chili. On March 27, one at Oajaca, Mexico. He does not mention an eruption of Colima. The earthquakes of March and April, 1872, were, according to Whitney, (*Overland Monthly*, vol. 9, p. 271), as follows:

March 6; central and eastern Germany.

March 11; destructive shocks in Japan.

March 23; Unionville and Winnemucca, Nevada.

March 26; the great earthquake at Inyo, which extended over all of California except its northern end, and throughout nearly all of Nevada.

March 26; City of Mexico—8-9 a. m.

March 26; Paducah, Ky.

March 28; Salt Lake City.

April 3; terrible shock at Antioch.

April 14; Accra; gold coast of Africa.

April 15; volcano of Merapi, Java, in eruption.

April 16, 17, 18; severe shocks in Iceland.

April 24; great eruption of Vesuvius.

April —; great eruption in the Philippine Islands.

March 26. The shock was felt at far as Winnemucca, Nevada—462 miles east of San Francisco.—B. Ms. Long, rolling, but moderate shocks in S. F. (V).—T. T. The persistent duration of the oscillations was remarkable and unique at S. F.

March 26. At Big Pine, Inyo County (X), there was a fissure opened from 50 to 200 feet wide, in places 20 feet deep, extending for miles, close to the eastern base of the Sierras. Near Fish Springs the earth was heaped up in ridges 5 to 10 feet high and 20 to 30 feet across. From Independence to Bishop's Creek (50 miles), the ground is cracked all over the surface. At Bishop's Creek the shock was severe, but light compared with that to the south. It commenced at 2.30 a. m., and from then to 6.30 a. m. there were not less than 50 shocks.—B. Ms.—*S. F. Bulletin*, March 28, April 1, 1872.

March 26. Lone Pine, Inyo County, Cal. (X). In Lone Pine every adobe and stone building was leveled to the ground. Sixty persons were killed and wounded in that place alone.—B. Ms. At Independence the damage to property was great. In other places in that county the loss of life and property was considerable. In Lone Pine the damage to property was $132,000; at Independence, $43,000; at Camp Independence, $26,000; in the county, $237,000.—B. Ms.—*Inyo Independent*, March 30, 1872.

In the same paper of April 13 the editor says the losses were overestimated. The total loss was less than $100,000. (The people at Lone Pine stopped the paper for *underestimating* the loss.)—*Inyo Independent*, April 20, 1872. During this earthquake not a single wooden building in Inyo County was injured to a dangerous extent, and not a single person in such a building was injured at all. One thousand shocks in two days.—Fuchs.

March 26. The Inyo earthquake was felt from the City of Mexico to Oregon. Shocks were felt on the same day at Paducah, Ky. At Camp Cady, A. T., its force was sufficient to move heavy wagons several feet (IX). The volcano of Colima, Mexico, burst into eruption on this day.—B. Ms.—*Inyo Independent*, April 20, 1872. [*Note.*—No eruption of Colima is mentioned by Fuchs.]

March 26. Millerton, Fresno County, 2.15 a. m. Shocks continued until 11 o'clock of the same day. No damage was done. At Bennett's Station, Merced County, a stone house was thrown down (IX). At Chowchilla, quite severe. At Fort Miller, quite severe. —B. Ms.—*Fresno Expositor*, April 30, 1872.

March 26. Fifty-two out of fifty-nine buildings were thrown down in Lone Pine, Inyo County. At Los Angeles artesian wells were seriously affected by earthquake. Some of them stopped entirely. At Glennville, Kern County, large and important springs opened. The larger Owens Lake was from 3 to 5 feet higher after the earthquake than before. The little lake 3 miles from Lone Pine entirely disappeared. Owens River, at Independence, dried up and remained dry for six hours. On Tuesday, the first day of the shocks, a dense fog or smoke prevailed over the valley. After the shocks, smoke and fire were seen issuing from the earth, the flames being blue. A river was opened and running between Lone Pine and Inyo Lake, 75 yards wide and 2 feet deep.—B. Ms.—*Healdsburg Russian River Flag*, April 25, 1872.

March 26. Inyo County. The night before was calm, clear and frosty, with the moon just past the full. At Big Pine the shock was very severe. At Bishop Creek somewhat less so. At Sierra, brick buildings were cracked. At Benton, the same. At Swansea buildings were leveled. At Belmont, a few stone cabins were thrown down (X).—B. Ms.—*Inyo Independent*, March 30, 1872.

March 26. Yosemite Valley (IX), many rocks fell, filling the valley with dust and smoke. The largest trees waved to and fro and were bent about like mere twigs.—B. Ms.—*S. F. Bulletin*, April 10, 1872.

The water of Owens Lake, Inyo County, rose very rapidly in July, 1872, sometimes as much as 4 or 5 inches in a night. During this period the water in Owens River, the main and almost only source of supply, was constantly diminishing. For a short time after the earthquake the waters of the lake fell several feet and became stationary, remaining at about the same point until the time mentioned. Previous to the earthquake the lake had been steadily rising for 10 years. Innumerable springs broke out all along the foothills.—B. Ms.—*Inyo Independent*, August 3, 1872. At Lone Pine, Big Pine, Independence, the shock was severest; at Bishop's Creek, Aurora (IX), Benton, and at the south end of Owens Lake the shock was less severe.

March 26 to April 10. Inyo, Cal. The shocks continued up to April 10 at intervals of a few hours, and in the mountains near by explosions were frequent, resembling distant artillery.—B. Ms.—*Alta*, April 11, 1872, April 12, 1872.

March 26. Cerro Gordo and Eclipse Mines, Inyo County, Cal. The rocking motion was distinctly observed, especially in the timbering, and the miners went to the surface, but soon resumed work.—B. Ms.—*Inyo Independent*, April 20, 1872.

March 26, San Francisco, 2.30 a. m. The shock was comparatively light in San Francisco, but was the most severe on record at other places. It extended at least from Red Bluff, in the north,

to Visalia, in the southern part of the State, and is said to have reached up into the Sierras to an elevation of 3,000 or 4,000 feet. The whole of the Sacramento, San Joaquin and Tulare Valleys were disturbed, the area of disturbance being 500 miles long by 60 to 100 miles wide. The shock was severest in the valleys. It appears to have been of greatest energy near Visalia, in the Tulare Valley, which is the bed of a former lake (IX). The alluvium was profoundly and frequently agitated, and shocks were long continued.—B. Ms.—*S. F. Bulletin*, March 26, 1872.

March 26. Marysville. Motion from south to north. Bangor, shock from the east.—B. Ms.—*Marysville Appeal*, March 27, 1872.

March 26. At the Kearsarge Mill in Inyo County, located at an altitude of nearly 8,000 feet above the sea, electric shocks from a stöve were felt.—B. Ms.—*Inyo Independent*, April 20, 1872.

March 26. Mariposa County. Several shocks all through this section of the country, continuing for several days.—B. Ms.—*Mariposa Gazette*, March 29, 1872.

March 26. Los Angeles. Vibrations were from east to west. In Anaheim they were from north to south. In Visalia the most damage was done. Brick buildings were strained and cracked. Some walls were thrown down. Upwards of 30 shocks occurred at Visalia.—B. Ms.—*Los Angeles Evening Express*, March 26, 1872.

March 26. Geyser Gulch, near headwaters of the San Joaquin (X). Miners' cabins in this vicinity were thrown to the ground with violence. This place is 40 or 50 miles from Independence, Inyo County.—B. Ms.—*Fresno Expositor*, April 10, 1872.

March 26. Grass Valley (VIII). Steeple of St. Patrick's Church swayed to and fro violently. *Grass Valley Union*, March 27, 1872.

March 26. Sacramento (VII). Several shocks, although no damage was done.—*Folsom Telegraph*, March 30, 1872.

March 26. Folsom (VII). Three distinct shocks at half-pâst two in the morning. Salmon Falls, the first shock lasted 2 minutes and was quite severe.—*Folsom Telegraph*, March 30, 1872.

March 26. Napa.—*Napa Reporter*, March 30, 1872.

March 26. See article by Prof. Le Conte.—*S. F. Bulletin*, April 12, 1872.

March 26. Los Angeles. B. Ms.—*Los Angeles Evening Express*, March 26, 1872.

March 26, 2.25 a. m. Placerville, Placer County, two or three distinct shocks in quick succession.—B. Ms.—*Placerville Democrat*, March 30, 1872.

March 26. Monitor.—B. Ms.—*Alpine Miner*, March 30, 1872.

March 26. Nevada City (VII), two shocks were felt, severe enough to cause nausea.—B. Ms.—*Nevada City Daily Transcript*, March 27, 1872.

March 26. The shock was reported as *light* at Antioch, Martinez, Santa Cruz, Pacheco, Napa.—H. Ms. At Woodland, Yolo County, the shock was felt at 2.25 a. m. and lasted 30 seconds.

March 26. The shock was reported as *severe*, or *very severe*, at Sacramento, Visalia, Red Bluff, Copperopolis, Sonora, Sutter Creek, Forest and Iowa Hills, Placerville, San José, Stockton, Santa Barbara, Hill's Ferry (Stanislaus County), Pescadero, and along the coast, Woodland (Yolo County), Chico, Colusa, Alpine County, San Diego, Salinas, Virginia City (Nev.), Marysville, Bakersfield, Los Angeles, San Juan Capistrano, Fort Tejon, Flores, Inyo Valley, Mariposa, Calaveras, Eureka.—H. Ms.

March 26. Articles on this earthquake may be found in *S. F. Bulletin*, March 26, 27, 28, 29, 30, April 1, 2, 3, 5, 8, 13, 24, May 10, 17; *Alta*, March 31, April 3; *Call*, March 27, 31, April 13, May 17; *Chronicle*, March 29 to May 4; *S. F. Golden Era*, March 31; *Pacific Observer*, March 29; *Inyo Independent*, April 6.

March 26. Accounts in *Mining and Scientific Press*, March 30, 1872, April 6 (description of the region by H. G. Hanks), April 30, May 11 (underground shocks), May 25. Professor Whitney, in *Overland Monthly*, Vol. 9, gives a very full and scientific account of this earthquake. "A fissure was opened in the earth from about 2 miles south of Lone Pine, extending ten miles further north. This fissure was 4 feet wide, and the ground on the east side sank from 4 to 12 feet lower than that on the west side (*or* the west side was raised). At the same time the ground on the east side was moved bodily 10 feet or so towards the north (or the other to the south). This was clearly shown by the position of fences running east and west."—Verbal account of Capt. Keeler, who has given me a photograph showing the shifting of the fences at a point 1½ miles south of Lone Pine.

1872. March 28;
Nevada City, Cal.—B. Ms.

1872. March 28;
Visalia.—B. Ms.

1872. March 29; V.
Los Angeles, Cal.; shock lasting 49 seconds, the longest ever felt here, though not the most severe.—B. Ms.

1872. April 3; early in the morning; V.
Two sharp shocks; Visalia, Cal.—B. Ms.

1872. April 3; 4:15 a. m.
Stockton.—B. Ms.

1872. April 9; 7 a. m.
Visalia.—B. Ms.

1872. April 10; 3 to 4 a. m.
Visalia, several shocks.—B. Ms.

1872. April 10; evening.
Sharp shock of extraordinary length.—B. Ms. (where?)

1872. April 10?; 7:10 p. m.
Stockton.—B. Ms.

1872. April 10; 7:20 p. m.; V.
Heavy shock at Tuolumne, which was also felt at Mokelumne Hill.—B. Ms.

1872. April 11; VI.
Tuolumne; severe shock, 4 a. m.; another, 5.30 a. m.; one more severe at 1 a. m. (*sic*); another at 9.30 p. m.; another severe at 10 p. m.—B. Ms.

1872. April 12;
Tuolumne, three shocks, 2.30 a. m.; one at 4 a. m., two at sunrise.—B. Ms.

1872. April 13; VI.
Round Valley, Inyo County, severe shock.—B. Ms.

1872. April 18; VII.
Cerro Gordo, Inyo County, very severe shock.—B. Ms.

1872. April 23;
Placerville, Cal.—B. Ms.

1872. April 28;
Millerton, Fresno County, Cal. A shock as violent as that of March 26, 1872 [?], though shorter.—B. Ms.

1872. April 28; V.
Severe shock at Nevada City, Cal., 8 seconds duration.—B. Ms.

1872. April 30; III.
Marysville, two light shocks.—B. Ms.

1872. May 1;
Salinas, Gilroy, Cal.—*Mining and Scientific Press.*

1872. May 17; VII.
Lone Pine. *Amer. Jour. Sci.*, IV (1872), p. 3.—C. G. R.

1872. May 21;
Shocks are still frequent in Inyo County. A number of the old craters are still emitting steam.—B. Ms. *Alta*, May 22, 1872.

1872. June 15;
Millerton, Fresno County, Cal.—B. Ms.

1872. August 23; 4 p. m.
Earthquake waves at Ft. Point for 20 hours.—*Mining and Scientific Press.*

1872. September 14; VII.
Owens River Valley, Inyo County, Cal.—C. G. R. Sharp shocks, but no damage done.—*Mining and Scientific Press.*

1872. September 18; evening.
Yountville, Napa County, Cal.—B. Ms.

1872. October 1;
San Francisco, Cal.—S. F. D.

1872. October 2;
San Francisco, Cal.—C. G. R.

1872. October 12; 4:10 a. m.; V.
Sharp shock. San Francisco, Cal.—T. T. Also Oakland. "A vertical shock."—C. G. R.

1872. October 18;
Millerton, Fresno County, Cal.—B. Ms.

1872. October 19;
Millerton, Fresno County, Cal.—B. Ms.

1872. October 21; 8:05 p. m.; IV.
Light shock, San Francisco, Cal.—T. T. Petaluma.—B. Ms. Also Vallejo, San Rafael.—B. Ms.

1872. November 12; at night.
Stockton, Cal.—C. G. R.

1872. November 21;
Petaluma.—B. Ms.

1872. December 14; 9:20-9:40 p. m.
Oregon and Washington Territory.—C. G. R. (see next paragraphs).

1872. December 14; 21h. 40m. 30s.	Puget Sound. One shock.
1872. December 14; 21h. 46m.; VII.	Puget Sound. Three shocks.
1872. December 14; 22h.	Puget Sound. Several shocks.
1872. December 14; 23h.	Puget Sound. Several shocks.
1872. December 15; 3h.	Puget Sound. Several shocks.
1872. December 15; 5h.	Puget Sound. One shock.
1872. December 16; 9h. 17m. 30s.	Puget Sound. One shock.
1872. December 16;	Eugene, Oregon. One shock.

—P.

1872. December 14, 15, 16; VII.

Olympia, W. T. Professor George Davidson kindly refers me to an account of these earthquakes in the *Weekly Pacific Tribune*, Olympia, December 21, 1872: "In an unofficial report to Professor Davidson, at San Francisco, Captain Lawson says, December 14, 1872: Shock occurred precisely at 9h. 40½m. It commenced with a slight movement, gradually increasing for 18 or 20 seconds. Then came the heavy shock, lasting 4 or 5 seconds; then it gradually decreased. In six minutes after the first shock there was another, followed by two others, one minute apart. At 10h. 12m. 40s. there was another shock, and after 11 p. m. there were five others. During the night other shocks were reported (I did not feel them) at 3 and 5 o'clock. On Sunday evening, December 15, at 6h. 37½m., a light shock. December 16, at 9h. 17m. 30s. a. m., another light shock. This shock was felt as far south as Eugene, in Oregon, and as far north as British Columbia—probably even in Alaska. In Victoria and elsewhere on Vancouver Island the shock is said to have been heavier than at any other point heard from. In Olympia we have heard of but a single article broken or damaged by the shock. This was a statuette, which was thrown from top of a "whatnot" and smashed on the floor. In the Seattle stores, we are informed, considerable quantities of crockery and glassware were broken. From what is so far known, the earthquake was confined mainly to the Puget Sound Basin, thence extending north and south with a gradually decreasing force, until it disappeared in a distance of 400 or 500 miles." The direction of the shock (December 14) at Olympia was south to north at first, then southeast to northwest.

1872. December 15;

A shock was felt at various places near Puget Sound, W. T.—C. G. R.

1872. December 16;

Visalia.—B. Ms.

1872. December 16 to 1873, January 4;

Walla Walla. Light shocks almost daily.—C. G. R.

1872-1875. (March);

No shocks at San Diego in this period.—B. Ms. [except 1873, Oct. 12.—E. S. H.].

1873. January 9; II.

Tacoma.—P.

1873. February 2; 3:30 p. m.; IV.

Light shock, San Francisco, Cal., lasting 5 seconds.—C. G. R.

1873. February 3; 3 p. m.; IV.

Light shock at San Francisco; severe at San José and Santa Clara (V).—C. G. R. Two shocks.—S. F. D.

1873. March;

San Diego Union speaks of a newly discovered volcanic region near Moleje, in Lower California. In 1872 twenty distinct shocks were felt; in 1870 five severe shocks.—C. G. R.

1873. April 10;

Mission San José.—B. Ms.

1873. April 12; in the evening; IV.

Three light shocks, San Francisco, Cal.—C. G. R.

1873. April 21;

Mission San Gabriel.—C. G. R.

1873. May;

San Bernardino.—B. Ms.

1873. June;

San Bernardino.—B. Ms.

1873. July 15; IV.

Slight shock, Napa, Cal.—C. G. R.

1873. August 29; 4 p. m.; VI.

Heavy shock at Mission San José, Cal.—C. G. R. Severe shock at Redwood, San Mateo County; time not given.—B. Ms. *S. F. Post*, September 3, 1873.

1873. October 12; 1:15 a. m.; V.

San Diego, Cal.—C. G. R.

1873. October 19; 2 p. m.; IV.

Slight shock, Seattle, W. T.; 4 p. m., clouds of smoke [?] were seen pouring from the highest peak of Mt. Rainier.—C. G. R.

1873. November 5;

Nevada.—B. Ms.

1873. November 22; a little after 9 p. m.; VIII.

A shock was felt from Portland, Oregon, to San Francisco, Cal.; most severe at Crescent City, Cal., and Port Orford, Oregon.—C. G. R. Nearly every brick building in Crescent City was injured; chimneys were damaged there and up the coast to Port Orford, in the interior as far as Jacksonville, Oregon, and east from Crescent as far as Happy Camp, on the Klamath.—B. Ms. At sea, N. of Cape Mendocino.—C. G. R.—Tacoma (III).—P.

November 22. Severe shock at Linckville, Klamath Lake, Oregon. In Jackson and Josephine counties, Oregon, and Trinity County, Cal., the shock was strong and lasted nearly a minute.—B. Ms. —Ft. Klamath, Oregon.—B. Ms. Red Bluff; Eureka; Albany (Oregon); Roseburg.—C. G. R.

November 22. This shock was very severe in Washington Territory. —B. Ms.

1873. December 3; V.
Sharp shock, Santa Clara, Cal.—C. G. R.

1873. December 17; 11-12 p. m.; IV.
Victoria, B. C.—C. G. R.

1873. December ?; [probably 17, E. S. H.]
Olympia. Three shocks.—P.

1874. January 18; III.
Two slight shocks, San Francisco, Cal.—C. G. R.

1874. January 19; III.
Slight shock, San Francisco, Cal.—C. G. R.

1874. March 5; 4:53 a. m.; V.
Sharp and short shock at San Francisco, Cal.—T. T.

1874. March 29;
Alpine County.—B. Ms.

1874. May 24; 2 a. m.; IV.
Two sharp shocks, San Francisco, Cal.—C. G. R. Slight shock.—S. F. D. [?]

1874. June 11; 8 p. m.; V.
Two sharp shocks, San Francisco, Cal.—C. G. R.

1874. August 3; in the evening; III.
Light shock, Clifton, San Bernardino County, Cal.—C. G. R.

1874. August;
Gilroy, Santa Clara County, Cal.—B. Ms.

1874. December 10;
Nevada [Cal.?].—B. Ms.

1874. December 14;
San Francisco, Cal.—B. Ms.

1874?
Tacoma (II).—P.

1875. January 24; 4 a. m.; VI.
Heavy shock in Butte, Plumas, and Sierra counties, Cal., direction from N. E.—C. G. R. At Oroville, Taylorsville, Greenville, and Downieville.—B. Ms. Carson (Nev.), N. E. and S. W., one light and one quite sharp shock.—C. W. F.

1875. February 7; 2 a. m., 10:45 a. m., 11:45 a. m.
Duration 2 sec. Three shocks, San Francisco, Cal.—C. G. R. Motions vertical. U. S. W. R.

1875. June 16;
San Francisco, Cal.—C. G. R.

1875. June 18; forenoon; III.
Slight shocks in San Francisco.—C. G. R.

1875. June 18; 3:35 a. m.; V.
Sharp shock, San Francisco, Cal.—T. T. 3 a. m.—S. F. D.

1875. August 8; in the morning; V.
Heavy shock was felt at Hollister, Cal.—C. G. R.

1875. October 14; 6 p. m.; V.
A sharp shock at San Francisco and in the Santa Clara Valley, Cal., with a heavy sea, without wind, from Santa Cruz to Cape Mendocino.—C. G. R. 5.55 p. m., S. F., Cal.—T. T.

1875. November 2; VI.
A severe shock at Fort Yuma, Arizona.—C. G. R.

1875. November 7; V.
Heavy shock in San Benito County, Cal.—C. G. R.

1875. November 14; 7:52 p. m.; IV.
Two shocks at San Francisco, Cal.—T. T. San José.—U. S. W. R.

1875. November 15; 7:55 p. m.
San Francisco, Cal.—C. G. R.

1875. November 27; 10:18 p. m.
San Francisco, Cal.—T. T.—C. G. R.

1875. December 2; 2:40 p. m.
Three shocks, Marysville, Yuba County, Cal.—B. Ms. See December 3.

1875. December 3; afternoon; V.
Grass Valley, Cal. "Heavy shock."—C. G. R. Light. Carson (Nev.), 3 p. m.—C. W. F.

1875. December 21;
Santa Barbara, Cal.—C. G. R.

1875. December 23; night.
In Placer, Nevada, and Yuba counties, Cal.—C. G. R.

1875. December 24; in the evening.
Grass Valley, Cal.—C. G. R.

1876. January 21; between 3 and 4 a. m.; III?
San José, Santa Cruz, and San Francisco.—C. G. R. "Very gentle" at Santa Cruz about 4 a. m.—Mr. Sawin's Diary.

1876. March 25; 6 a. m., 1 p. m.; III.
Two slight shocks, Oakland, Cal.—C. G. R.

1876. May 10;
Santa Barbara, Cal.—C. G. R.

1876. August 16; 1:15 p. m.
Lat. 41° 55′ N., long. 126° 25′ W., off the southern part of Oregon.—C. G. R. (Heavy.)

1876. October 6; 9:20 and 10:08 p. m.
San Francisco, Cal., Oakland, San José, and Angel Island.—C. G. R. (Lasting 10 sec.)

1876. October;
White Sulphur Springs. ?—B. Ms.—Ashland (Oregon) *Tidings*, October 28, 1876.

1876. December 11; 7 p. m.
At Silver Mountain, Cal., a series of seven shocks within thirty minutes. A slight shock at 3 o'clock the next morning.—C. G. R.

1877. January 10; 1:15 ?; III.
A slight shock at Los Angeles, Cal.; at Benedict Cañon, near there, three distinct shocks.—C. G. R.

1877. January 13; about noon; VI.
A heavy earthquake forty-five miles southeast of San Diego.—C. G. R.

1877. February 17; morning; V.
Heavy shock at Quincy, Plumas County, Cal.—C. G. R.

1877. May 30; between 2 and 3 a. m.; V.
Heavy shock at Paso Robles, Cal.—C. G. R.

1877. May;
Tidal waves at San Francisco. Diagram given at p. 169 of Milne's *Earthquakes.*

1877. June 23; a few minutes before midnight.
Santa Barbara, three shocks.—B. Ms. 11.30 p. m., Bakersfield, Cal. "Vertical."—C. G. R.

1877. July 2; 10:35 a. m.
Gilroy.—B. Ms. *S. F. Bulletin*, July 5, 1877.

1877. July 9;
A shock at Sacramento, Cal., lasting one minute.—C. G. R. Carson (Nev.), 11.10 p. m., N. and S.; light.—C. W. F.

1877. August 17; 7:30 p. m.; V.
Heavy shock at Campo, Cal.—C. G. R.

1877. August 27;
Eureka, Humboldt County, Cal.—B. Ms.

1877. August;
S. F., Cal.—B. Ms. *Antioch Ledger*, September 1, 1877.

1877. September 7; 10 p. m.
Yuma, Arizona.—Fuchs.—C. G. R.

1877. September 19; about 4 p. m.
Los Angeles, Cal.—B. Ms.—*S. F. Bulletin*, September 22, 1877.

1877. September 29; 2:30 p. m.
Campo, Cal.—C. G. R.

1877. October 12; 1:53 p. m.; VIII.
Portland, Oregon; 1.45 p. m., Marshfield, Oregon; 1.52 p. m., Cascades, Oregon; 9 a. m., Cascades, Oregon.—C. G. R. (Chimneys overthrown.)—P.

1877. October 26; 5-6 p. m.
Lat. 43° 13′, long. 128° W.—Severe shock.—C. G. R.

1877. November 24; 6:30 a. m., 6:50 a. m.
Two shocks at Red Bluff, Cal. (V).—C. G. R.—S. F. (III).—C. G. R.

1878. January 8;
Santa Barbara, Cal.—B. Ms.—*S. F. Golden Era*, January 12, 1878.—*Stockton Independent*, January 10, 1878.

1878. February 26; 11:56 a. m.; IV.
San Francisco, Cal.—U. S. W. R.

1878. March 17;
Two sharp shocks at St. Thomas, Lower California.—U. S. W. R.

1878. March 18; 6:30 a. m.; III.
Tacoma, W. T.—U. S. W. R.—(Slight.)

1878. April 23; 10 a. m.
Heavy earthquake at *Loreto*, Gulf of California. Shocks continued till May 2d.—Fuchs.

1878. May 8; 8:25 p. m.; VI.
From Red Bluff to Sacramento City, Cal., also in Mendocino County.—C. G. R. (Clocks stopped.)

1878. May 21;
San Bernardino, Cal.—U. S. W. R.

1878. June 11-12; 11:12 p. m. (III); 11:20 p. m. (V); 2:30 a. m. (III), and 6:30 a. m. (I);
Four shocks at Los Angeles, Cal.—U. S. W. R.

1878. July 2; 5h. 55m. 30s. (a. m. or p. m.?); III.
Two light shocks at Campo, Cal.—U. S. W. R.

1878. July 26; 8:25 a. m.
Los Angeles, Cal., San Gorgonio.—C. G. R.; and San Bernardino.—Fuchs.

1878. September 7; about 9:35 a. m.
Three shocks at San Francisco, Cal.—U. S. W. R.

1878. September 7; 11 a. m.
Severe earthquake in the southern portion of Humboldt County, Cal.—B. Ms.

1878. September 29; 6 p. m.
San Francisco and Oakland, Cal.—C. G. R.

1878. October 11; 7:30 p. m.; V.
A severe shock at San José, Cal.—U. S. W. R.

1878. October 21; 5:40 p. m.
Two shocks at Sacramento, Cal.—U. S. W. R.

1878. November 11; 9:45 a. m.; III.
A slight shock at San Francisco, Cal.—U. S. W. R.

1878. December 9; 3:20 p. m.; V.
A severe shock at Red Bluff, Cal.—C. G. R.

1878. December 17; 4 p. m.
Two shocks at Campo, Cal.—C. G. R. Also Yuma, Arizona.—Fuchs.

1879. ?
Portland, Oregon.—P.

1879. February 4; 0h. 8m. a. m.
A shock at Visalia, Cal.—C. G. R.

1879. February 19; a few minutes after 5 a. m.
San Francisco, Cal.—C. G. R.

1879. May;
?—B. Ms.—*Esmeralda Herald*, May 31, 1879.

1879. May 26; 8:40 p. m.
Princeton, Colusa County, Cal.—U. S. W. R.

1879. August 10; 1:15 p. m.
A very light shock at Los Angeles, Cal. (II). Tidal wave at Santa Monica. Quite severe shock at San Fernando (IV? V?).—C. G. R.

1879. August 18;
A shock at Fiske's Mills, Sonoma County, Cal.—C. G. R.

1879. October 2; 6:30 a. m.; V.
Oakland, Cal., and round the bay, "a sharp shock."—C. G. R.

1879. December 7; 8:15 p. m.; III.
A slight shock at Los Angeles, Cal.—U. S. W. R.

1879. ? ?
There was a smart shock in Portland, Oregon—and only two or three shocks have been felt since that time.—Communicated by Geo. J. Ainsworth, Esq.

1880. January 9; 5:45 a. m.
Santa Cruz, Gonzales, and Hollister, Cal.—C. G. R.

1880. March 21; 6:25 a. m.; V.
A heavy shock, Los Angeles, Cal.—U. S. W. R.

1880. March 25; 2:30 a. m.; IV.
Moderate shock, San Gorgonio, Cal.—U. S. W. R.

1880. April 12; 4:40 a. m.; V.
Severe shock at Los Angeles; most severe on San Gabriel River; 4.30 a. m. sharp shock at Riverside, San Bernardino County.—*S. F. Chronicle*, April 13, 1880.

1880. April 12; 8:03 a. m.; V.
Severe shock at San Buenaventura, Ventura County, Cal.—*S. F. Chronicle*, April 13, 1880.

1880. April 14; 1:05 p. m.; V.
Strong shock, San Francisco.—C. G. R. Oakland.—B. Ms.

1880. May 5; 11 p. m.; IV.
Slight shock, San Francisco, Cal.; 11.35 p. m., San José.—C. G. R.

1880. June 24; 12:47 a. m.
San Francisco, Cal.—U. S. W. R.

1880. August 22; 1:25 p. m.
Southern part of Vancouver Island and northwest part of Washington Territory.—Fuchs.—C. G. R.

1880. August 29; 1:10 p. m.; III.
A slight shock, San Diego, Cal.—U. S. W. R.

1880. September 26; 5:40 p. m.
Los Angeles, Cal.—U. S. W. R.

1880. November 4; 7:37 p. m.
Sharp shock at San Francisco, Cal. (V). Felt slightly at San José (III).—C. G. R.

1880. November 6;
Newcastle, *Cal.*—Fuchs. Newcastle, *Ontario.*—C. G. R.

1880. November 12; 8:45 p. m.; III.
Slight shock at Los Angeles, Cal.—C. G. R.

1880. November 12; 10:30 p. m.
Santa Barbara, Cal.—C. G. R.

1880. November 21; 8:10, 11 p. m., and 2:30 a. m.; or 7:45, 9:45, and 11 p. m.
Los Angeles, Cal.—C. G. R.

1880. December 7?; 5:54 p. m.
Olympia, W. T.; also at Bainbridge Island, W. T.—C. G. R. Dec. 6 (IV).—P.

1880. December 10; 5 a. m.
Bainbridge Island, W. T. "Vertical shock."—U. S. W. R.—Puget Sound (IV).—P.

1880. December 12; 8:40 p. m.
Severe shock near Puget Sound, W. T., from Victoria to Portland.—C. G. R. (VII).—P.

1880. December 14; 7 p. m.; III.
Slight shock was felt at Bainbridge Island, W. T.—U. S. W. R.

1880. December 19; between 2 and 3 a. m.; V.
Los Angeles, Cal. 3.40 p. m., from Los Angeles to San Diego.—C. G. R.

1880. December 20; 11:16 p. m.
Bainbridge Island, W. T.—U. S. W. R. Puget Sound (IV).—P.

1880. December 21; 11 p. m.; V.
Sharp shock at San Diego and Campo, Cal. 3.22 a. m., Campo, Cal.—C. G. R.

1880. December 26; 2:30 p. m.; III.
Tecaluma, San Diego County, Cal. "Slight."—U. S. W. R. [Marin Co.?]

1880. December 28; 11 p. m.; V.
Severe shock, Tecaluma, Cal.—U. S. W. R.

1880. December 29; 11:25 p. m.; III.
Slight shock, Bainbridge Island, W. T.—U. S. W. R.

1881. January 1; 6:55 p. m.
Red Bluff, Cal.—U. S. W. R.

1881. January 5-7; III.
Bainbridge Island, W. T. Slight shocks at 10.56 p. m. of 5th. Slight shocks 4.20 p. m. of 6th. Slight shocks at 10.15 p. m. of 7th.—U. S. W. R.

1881. January 6; 6:25 p. m.
Red Bluff, Cal.—U. S. W. R.

1881. January 7; 6:15 a. m.; III.
Slight shock, Campo, Cal.—U. S. W. R.

1881. January 16; 11 p. m.
Slight shock, Bainbridge Island, W. T.—U. S. W. R.

1881. January 24; 8:54 p. m.; 9:15 p. m.; 11:15 p. m.
Three shocks, San Francisco and Oakland, Cal.—C. G. R.

1881. January 30; 9:45 p. m.; III.
Slight shock, Bainbridge Island, W. T.—U. S. W. R.

1881. February 1; 4:11 p. m. (three shocks); 9:53 p. m. (two shocks).
Visalia, Cal.—U. S. W. R.

1881. February 2; III.
Slight shock at Salinas City, Cal.—U. S. W. R.

1881. February 14; about 1 o'clock; III.
Slight shock at Ukiah, Cal.—C. G. R.

1881. March 14; 10:30 p. m.; III.
Slight shock at Bainbridge Island, W. T.—U. S. W. R.

1881. April 10; 2 a. m.-2:15 a. m.; V.
Several severe shocks in Central California.—C. G. R.

1881. April 27; 9:10 p. m.
Los Angeles, Cal.—U. S. W. R.

1881. May 14; 13h. 9m.; IV.
Slight shock at Berkeley, Cal.—*Trans. Seismol. Soc. of Japan*, vol. x, p. 95.

1881. June 30; 8 a. m.; V.
Sharp shock at Campo, Cal.—U. S. W. R.

1881. July 2; 11 p. m.
San Juan, San Benito County, Cal.—C. G. R.

1881. July 3; 2:10 a. m.; V.
Heavy shock at Hanford and Visalia, Cal.—C. G. R.

1881. August 30; 7 p. m.; III.
Two slight shocks at Santa Barbara, Cal.—U. S. W. R.

1881. September 18; 5:20 p. m.
Severe shock at San Francisco, Cal. (V).—C. G. R. Angel Island (III).

1881. October 2; 9 a. m.; V.
Sharp shock, Campo, Cal.—U. S. W. R.

1881. October 21; 6:41 p. m.
Carson (Nev.), N. and S., two light shocks.—C. W. F.

1881. October 31; 4:10 p. m.; III.
Slight shock, San Francisco, Cal.—T. T.

1881. November 9; 10:08 a. m.
Carson (Nev.), N. and S., sharp shock, lasting two seconds.—C. W. F.

1881. November 11; 4 p. m.; III.
Slight shock, San Francisco, Cal.—U. S. W. R.

1881. November 13; 11:15 p. m.; V.
Smart shock, San Francisco, Cal.—T. T. 11.20 p. m.—U. S. W. R.

1881. November 15; at noon; V.
San José, Cal.—C. G. R. "Severe."

1882. January 26; evening; V.
Two severe shocks, Centerville, Cal.—C. G. R.

1882. February 3; 2:40 a. m.; IV.
Sharp shock, San Gorgonio, Cal.—U. S. W. R. "Direction doubtful."

1882. March 6; 2 p. m.; V.
Successive shocks at Merced; 1.57 p. m., two severe shocks at Santa Cruz; 1.45 p. m., two severe shocks at Gilroy; 1.45, one severe shock at Monterey; 1.47½, severe shock at Watsonville.—B. Ms. *S. F. W. Call*, March 9, 1882.

1882. March 11; 3:30 p. m.
Poway, San Diego County, Cal.—C. G. R.

1882. March 11; 4 p. m.; III.
Slight shock, San Diego, Cal.—C. G. R. 4.25 p. m.—H. Ms.

1882. March 16; 1:46 p. m.; III.
Light shock, San Francisco, Cal.—U. S. W. R.

1882. March ?; III.
Two slight shocks in Salinas, Cal., during the month.—Fuchs.

1882. April 13; 6:30 a. m.; V.
Sharp shock, San Francisco, Cal.—U. S. W. R.

1882. April 30; 10:48 p. m.; IV.
Two shocks, Portland, Oregon.—C. G. R.—P.

1882. May 1; 12:25 a. m.
Portland, Oregon.—Fuchs.

1882. June 27; 5:22 a. m.
Two severe shocks, four seconds apart, San Francisco, Cal. (V).—C. G. R. Also Petaluma, Hollister and Stockton.—Fuchs.

1882. July 15; 7:45 p. m.; V.
Sharp shock, San Francisco, Cal.—C. G. R. Heavy shock at Centerville, Alameda County.—H. Ms.

1882. July 22; 11:08 a. m.; II.
Very light shock at San Francisco, Cal.—U. S. W. R.

1882. July 31; about noon; III.
Light shock at Cape Mendocino, Cal.—U. S. W. R.

1882. August 8; III.
Light shocks at Oakland, Cal.—U. S. W. R.

1882. August 9; 8:45 p. m.; III.
Light shock at San Francisco, Cal.—U. S. W. R.

1882. August 13; night; VI or more severe.
Seven shocks at Round Valley, Inyo County. Two shocks between 12 and 1, night, were very severe.—H. Ms.

1882. August; twice during the month.
Salinas, Cal.—U. S. W. R.

1882. September 30; 10:57 a. m.; V.
Sharp shock at Campo, Cal.—U. S. W. R.

1882. October 8; 2 a. m.; V.
Heavy shock at San Diego, Cal.—C. G. R.

1882. October 20; 2:15 a. m.
Severe shock at San Francisco, Cal.—C. G. R.

1882. October 20; 3:10 a. m.; V.
Sharp shock in San Francisco, Cal.—T. T.

1882. October 31; 6:45 p. m.
Sharp shock, San Francisco, Cal. (V); felt, also, at Sonoma, Napa, Petaluma, and San Rafael.—C. G. R.

1882. November 11; 7:30 a. m.; V.
Severe shock at Mendocino.—H. Ms.

1882. December 19; 11:45 p. m.
Two light shocks, Visalia, Cal. (IV).—U. S. W. R. Bakersfield, two shocks at 11.30.—H. Ms.

1883. January 23; 5h.; III.
Slight shock, Los Angeles, Cal.—U. S. W. R.

1883. January 23; 11:40 p. m.
Light shock in San Francisco, Cal.—T. T. *Sharp* shock.—U. S. W. R.

1883. February 6; 16h. 30m.; III.
Slight shock, San Diego, Cal.—U. S. W. R.

1883. March 21; shortly before 1 a. m.; V.
Centerville (Alameda County), severe.—H. Ms.

1883. March 21; 4:30 a. m.; V.
Mendocino.—H. Ms. (Sleepers waked.)

1883. March 30; 7h. 48m., 7h. 52m., 8h. 15m.
Three shocks, San Francisco, Cal. (IV); nine shocks, Watsonville.—C. G. R. Light shock, S. F., 8.10 a. m.—T. T. 7.39 a. m. at Hollister (VI); very heavy shock, windows broken, etc.—H. Ms.
March 30. 7.45 a. m.; Santa Cruz, three shocks (VI). 7.42 a. m.; Watsonville, violent shocks, nine in all (VI); pendulum clocks were stopped. 7.35 a. m.; San Luis Obispo. 7.50 a. m.; Centerville, three shocks. About 8 a. m.; Mission San José, several sharp shocks (V). 7.40 a. m.; Gilroy (V), glass broken. 8 a. m.; Martinez, two shocks. 7.40 a. m.; Salinas. 7.45 a. m.; Monterey.—H. Ms.

1883. April 2; 8h. 50m.; IV.
Two light shocks, San Francisco, Cal.—U. S. W. R.

1883. May 10; night.
Victoria, B. C. (III).—C. G. R.

1883. June ?;
Tacoma (III).—P.

1883. July 1; 3 a. m.
Carson (Nev.), light.—C. W. F.

1883. July 7; 10h. 50m.; II.
Light shock at Los Angeles, Cal.—U. S. W. R. (Direction?)

1883. July 30;
Two shocks, Gilroy, Cal.—C. G. R. July 31?—Fuchs.

1883. August 4; 11h. and 12h. 50m.
Two light shocks at Oakland, Cal.—U. S. W. R.

1883. August 19; 2:55 a. m.
Carson (Nev.). Three light shocks.—C. W. F.

1883. August 27; 1h.
Prof. Davidson reports earthquake waves at Saucelito.—C. G. R.

1883. August 31;
Los Angeles.—H. Ms.

1883. September 1; 8h. 25m.; III.
Light shock, Los Angeles, Cal. A second shock four seconds later.—U. S. W. R.

1883. September 5; 4h. 30m.; VI.
Shocks at Los Angeles, Santa Barbara, Wilmington, and San Buenaventura, Cal.—C. G. R.

1883. September 13; 14h. 30m.; IV.
Santa Barbara, Cal., lasting 5 seconds.—U. S. W. R.

1883. September 28; about midnight.
Two shocks, Portland, Oregon.—C. G. R.—0h. 0m. 10s., Portland. Two shocks.—P.

1883. October 8? or 9?
6.45 p. m., light shock at Salinas (III); 7.50 p. m., much stronger at Salinas (V); 9.45 p. m., another at Salinas; Santa Cruz (V), a severe shock.—H. Ms.

1883. October 9; 23h. 3m.; IV.
Two light shocks, San Francisco, Cal.—C. G. R.

1883. October 10; 1:05 a. m.; V.
Sharp shock in San Francisco.—T. T. Heaviest since 1868.—B. Ms. Not felt at Sacramento. Severe at Gilroy and Port Costa.—H. Ms. Davisville reports a severe shock; Berkeley; Oakland.—H. Ms. Detaille (*L'Astronomie*, 1885, p. 188).

1883. October 16; 3h. 15m.
A slight shock at Cape Mendocino, Cal.—U. S. W. R.

1883. October 22; 6 a. m.; VIII or more severe.
South side of the Merced River, below Merced Falls; a shock threw a section of the bluff two hundred feet by sixty by eighty feet, into the river. A sharp shock a few minutes before midnight. —H. Ms.

1883. October 24; 16h. 14m.; VI.
A severe shock at Cape Mendocino, Cal.—U. S. W. R.

1883. October 30; in the morning; III.
Two light shocks at Oakland, Cal.—U. S. W. R. Light shock at S. F. —T. T.

1883. November 11; 18h. 15m.; III.
Slight shock at Poway, San Diego County, Cal.—U. S. W. R.

1883. December 3; V.
Severe shock at Shasta, Cal.—H. Ms.

1883. December 12; 23h. 40m.; III.
A slight shock at Los Angeles, Cal.—U. S. W. R.

1883. December 12; 1:50 a. m.; V.
Heavy shock at Salinas, Cal.—H. Ms.

1883. December 13;
Los Angeles, Cal.—U. S. W. R.

1883. December 16?; 15h.
A slight shock at Poway, San Diego County, Cal.—U. S. W. R.

1884. January 3; 20h. 40m.; IV.
A light shock, Portland, Oregon.—U. S. W. R. One shock.—P.

1884. January 4; 11h. 56m.; III.
Very light shock, Los Angeles, Cal.—U. S. W. R.

1884. January 25; I.
Professor George Davidson, of the U. S. C. S., reported from San Francisco that at 19h. 24m. earthquake waves were indicated by the levels of the astronomical instruments of the observatory, and they continued for twenty minutes.—C. G. R.

1884. January 27; 23h. 30m.; VII.
Moderate earthquake in Humboldt County, Cal. A second shock five minutes later.—C. G. R. (Eureka, Hydesville, Cape Mendocino.)

1884. March 15; 3h. 7m.; III.
Very light shock, San Francisco, Cal.—C. G. R.

1884. March 25; 4:40 p. m.
Severe shock, San Francisco, Cal. (VI). At 5.17 another less severe, Oakland and Berkeley (VI). Shocks felt from Santa Cruz to Petaluma.—Fuchs. 4.44 p. m.—T. T. Professor Davidson gives times of three shocks. At Gilroy, severe shock (VII); at Centerville, light (IV); at Santa Cruz, severe (V); at Petaluma, quite

severe (V); at Redwood City, quite severe (V); Mission San José, two heavy shocks (V); Spanishtown, severe (V); San José; Grass Valley.—H. Ms.

1884. April 6; 6h. 20m.; III.
A very light shock at Eureka and Hydesville, Humboldt County, Cal.—C. G. R.

1884. April 8; III.
In the morning very light shocks, Eureka, Cal.—U. S. W. R.

1884. April 11; III.
Light shock, Eureka, Cal.—Fuchs. Carson (Nev.), 2.10 P. M., N. W. and S. E. (IV), vertical shock.—C. W. F.

1884. April 17; 21h. 10m.; IV.
Light shock at Oakland, Cal.—U. S. W. R.

1884. April 20; 11h. 30m.; III.
A very light shock at Oakland, Cal.—U. S. W. R.

1884. June 6; 1h.; VII.
Two strong shocks were felt at Red Bluff, Cal., with an interval of three or four seconds.—C. G. R. (Walls cracked.)

1884. June 12; 8h. 43m.
A strong shock is reported by Captain C. F. Swan to have been felt at sea, in latitude 40° 24′ north, longitude 125° 50′ west, being about seventy-five miles west of Cape Mendocino, Cal.—C. G. R.

1884. June 16; 10h. 48m.
Los Angeles, Cal.—U. S. W. R.

1884. July 15; about daylight; III.
A very light shock at San Francisco, Cal.—U. S. W. R.

1884. August 2-3; in the night; III.
A very light shock at Santa Barbara, Cal.—U. S. W. R.

1884. August 3;
Lower Lake, Lake County, Cal. Shocks day and night.—H. Ms.

1884. August 4; 1h.; III.
Three very light shocks at Santa Barbara, Cal.—U. S. W. R.

1884. September 21; between 22h. and 23h.; III.
Light shocks were felt at New Tacoma, W. T.—U. S. W. R.—22h. 30m., Tacoma.—P.

1884. September 26; 10:53 p. m.; III.
Light shock at Yuma, Arizona.—Fuchs.

1884. September 27; 3 a. m.; III.
Light shock at Yuma, Arizona.—Fuchs.

1884. October 22; 15h. 34m.; III.
A light shock at Los Angeles, Cal.—U. S. W. R.

1884. November 4; 18h.
Three shocks 150 miles off Cape Mendocino, Cal., followed a few hours later by two heavier ones.—U. S. W. R.

1884. November 9;
Three earthquakes at Hollister, Cal.—A. S.

1884. November 12;
The self-registering tide gauge at Saucelito, Cal., recorded a series of waves probably due to a submarine earthquake.—C. G. R.—*San Francisco Evening Bulletin* of December 13.

1885. January 26; 1h. 33m., 120th meridian time.
A moderate earthquake (V) occurred in Central California from San Francisco, northward, to Napa and Petaluma.—U. S. W. R. Sharp shock, 1.32.—T. T. San Francisco (V); San Rafael (V); Oakland (V).

1885. January 26; 8:57 p. m.; IV.
Light shock in San Francisco, Cal.—T. T. Light shock (IV) Central California.—C. G. R.

1885. January 30; about 10:45; VIII.
Honey Lake Valley, Lassen County, Cal. Shock lasting over a minute; breaking glass and throwing down chimneys. In the ten days preceding February 8th, probably over one hundred distinct shocks have been felt. Shocks were most severe about Janesville, and on Susan River, twelve miles from Susanville.—H. Ms. See Feb. 26.

1885. January 30; 9:40 p. m.
Shock twenty seconds long in Sierra County.—H. Ms. At Susanville the shocks lasted from 9 p. m. to 4 a. m. Thirteen shocks were felt in places in the valley.—H. Ms.

1885. January 30; 21h. 38m., 120th meridian time.
A very light shock (III) at Sacramento, Cal.—U. S. W. R.

1885. February 5; 23h.
A moderate shock (V?) at Geyser Springs, Sonoma County, Cal.—C. G. R.

1885. February 6; 2h.
A moderate shock (V?) at Geyser Springs, Sonoma County, Cal.—C. G. R.

1885. February 7; night; V.
Four severe shocks at Susanville.—H. Ms.

1885. February 22; 18h. 53m.
A very light shock (III) at Newcastle, Placer County, Cal.—C. G. R.

1885. February 26;
The earthquakes still continue in the vicinity of Susanville. One shock recently, it is said, shook down the curbing of a well. The shocks appear to be local, as none are felt one hundred miles from here. This locality is in Lassen County, in the extreme northeastern part of the State.—(S. F. C.)—C. G. R.

1885. March 30; 28h. 56m., 120th meridian time; VI.
A strong shock (VI) in Central California, from San Rafael, Marin County, to Monterey, Salinas, and Hollister.—C. G. R. San José (VI).

1885. March 31; about 3h.
A very light earthquake (III) at Fall Brook, San Diego County, Cal.—U. S. W. R.

1885. April 2; 7h. 15m.
A very light shock (III) Sacramento, Cal.—C. G. R.

1885. April 2; 7h. 25m.
A light shock (IV) at Merced and Fresno, Cal.—C. G. R.

1885. April 3; 10h. 15m.; III.
Sacramento, 2 shocks.—C. G. R.

1885. April 7; 2h.
Santa Barbara and San Buenaventura, Cal.—C. G. R.

1885. April 7; 2h. 30m.; IV.
A light shock, Bakersfield, Kern County, Cal.—C. G. R.

1885. April 11; 20h. 5m., 120th meridian time.
A strong shock (VI), Central California.—C. G. R. Monterey, Salinas, Merced, and Stockton (VI); Marysville, S. Rafael, S. Francisco, Hanford and Keeler (III).

1885. April 18; shortly before midnight.
A moderate shock (V), Keeler, Inyo County, Cal.—U. S. W. R.

1885. April 25; 20h. 20m.
A very light shock (III), Hydesville and Blue Lake, Humboldt County, Cal.—C. G. R.

1885. May 3; 23h. 30m., local time.
A very light shock, Olympia, W. T. Light shocks continued until 1h. 30m. of the 4th.—U. S. W. R. (II). At intervals for 2 hours.—P.

1885. June 14; 3h. 14m., 120th meridian time; V.

A moderate earthquake, San Buenaventura, Ventura County, and Los Angeles and Cahuenga, Los Angeles County, Cal.—C. G. R.

1885. June 25; 20h. 30m.

A very light shock (III), Salinas, Cal.—U. S. W. R.

1885. June 27; 5h. 26m.

A light shock (IV), Olympia, W. T.—U. S. W. R.

1885.

Three earthquakes noted during the summer at Kono Tyee, Clear Lake, Cal., by R. S. Floyd, Esq.

1885. July 9; 1h. 20m. to 8h. 15m.

Five moderate earthquakes (V), Santa Barbara, Cal.—U. S. W. R.

1885. July 22; 19h.

A very light shock (III), Centerville, Cal.—C. G. R.

1885. July 23; 12h. 25m.

A moderate shock (VI), San José, Santa Clara County, and Centerville, Alameda County, Cal.—C. G. R. Gilroy and Sta. Clara (VI).

1885. July 31; 16h. 10m.

A strong shock (VII), Cloverdale, Sonoma County, Cal.—C. G. R.

1885. September 13; 4h. 34m.

A light shock (IV) in Southern California.—C. G. R.

1885. September 20; about 7 a. m.

San Diego.—H. Ms.

1885. October 9; 8h.

A moderate shock (V), Olympia, W. T.—C. G. R. (III).—P.

1885. October 10; between 1h.-2h.

Three very light shocks (III), East Portland, Oregon.—U. S. W. R.—1h. 30m. (II).—P. *See* 1886, October 13.

1885. October 16; 4h. 45m., 120th meridian time.

A light earthquake (IV) in Central California, very faint in San Francisco (II), light in San Rafael (III), and heavier in Napa and Santa Rosa (IV).—C. G. R.

1885. November 19; between 13h. and 20h.; I.

Earthquake waves were indicated on the coast survey tide-gauge at San Francisco.—C. G. R. And on the levels of astronomical instruments at intervals of 35m.—*Nature.*

1885. December 8; 22h. 40m., 120th meridian time.

A moderate shock (V) Puget Sound, W. T.—C. G. R.—22h. 40m., Tacoma.—P.

1885. December 8; 10:12 p. m.; V.
Sharp shocks at Victoria and New Westminster, B. C.—H. Ms.—22h. 12m.—P.

1885. December 18; 0h. 30m.
A very light shock (III) Tatoosh Island, W. T.—U. S. W. R.

1885. December 21; morning.
Slight shock; Susanville (IV).—H. Ms.

1885. December 28; between 3h. and 4h.; V.
Santa Cruz, Cal.—U. S. W. R. Two heavy shocks.—H. Ms.

1885. December 30; 9:45 a. m.
Light and rattling shock in San Francisco, Cal. (III).—T. T. Around the bay.—C. G. R. Oakland; heavy at Napa at 9.51 (V); severe at Redwood (V) at 9.40; Vallejo Junction and Port Costa 9.46½; slight at Santa Cruz (III) at 9.45; severe at Petaluma (V), 9.47; severe at Martinez (V), 9.50; severe at San Mateo (V), 9.45.—H. Ms. Probably at San José.—E. S. H.

1886. January 26;
San Francisco and vicinity.—A. S.

1886. May 24;
Fresno, Cal.—A. S.

1886. May 25; 3 a. m.
Two shocks, San Francisco, Cal.—H. Ms.

1886. May 26;
Earthquake shocks felt in different parts of California.—A. S. Santa Cruz (four shocks); Irving (two shocks).—H. Ms.

1886. May 26; 12:17 p. m.; IV.
Slight shock, San Francisco, Cal.—H. Ms. *S. F. Bulletin*, May 27, 1887; 0.16 p. m.—T. T.

1886. June 7; 1:32 p. m.; III.
Light shock in San Francisco, Cal.—T. T.

1886. July 2; 0:10 a. m.; III.
Light shock in San Francisco, Cal.—T. T.

1886. July 2;
Stockton, Cal.—A. S.

1886. September 3;
Earthquake shocks felt in several California towns.—A. S.

1885? 1886? October 13; a little after 8 p. m.
Fort Point Lighthouse, S. F., Cal.—*Report of L. H. Board* for 1885-6.

1886. October 15;

Fort Point Lighthouse, S. F., Cal., 9.59 p. m.; Mare Island Lighthouse, Cal., 10 hours, ½ minute, p. m.—*Report of L. H. Board* for 1885-6. 10.05 p. m., S. F., Cal. (IV).—T. T.

1886. November 11; 7:11 p. m.; III.

Slight shock at San Francisco.—A. S.

1886. December 6; IV.

San Francisco; also Santa Cruz.—A. S.

1887. January 3; 4:29 p. m.

Humboldt Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.

1887. January 8; 2:20 a. m.

Cape Mendocino Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.

1887. January 11; 4:11 a. m.

Fort Point Lighthouse, S. F., Cal. Pigeon Point Lighthouse, Cal., 4 a. m.—*Report of L. H. Board* for 1885-86. 4.10 a. m., S. F., Cal.—T. T. Two shocks.—A. S.

1887. January 15; 10:58 p. m.

Point Arena Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.

1887. January 19; 3:15 a. m.

Point Arena Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.

1887. January 19; 10:25 p. m.

Mare Island Lighthouse, Cal.—*Report of L. H. Board* for 1885-6.

1887. January 31;

Sharp shock at Bakersfield, Cal.—A. S.

1887. April 24; night; II.

Slight shock recorded on seismometer of Lick Observatory.

1887. April 29;

Shocks in Walla Walla Valley, W. T.—A. S.

1887. May 3; II.

Slight shock recorded on seismometer at Lick Observatory.

1887. May 3; 2:48 p. m.

I have no record of this shock at Fort Yuma, but I assume it to have been felt there. In *Science*, 1887, May 20, p. 483, under the heading, *The Sonora Earthquake*, is a good account by G. E. Goodfellow, of the shock at Tombstone, Arizona. At this place there were loud detonations. The severe shaking lasted 10 seconds, the moderately severe about 20, and tremors a little over one minute. No building of any stability was damaged, and no person was

injured. The railroad track of the A. T. and St. F. R. R., at a point where it ran east and west, was thrown $4\frac{1}{2}$ inches out of line, the convexity looking south. The bend was 300 feet long. For 48 hours after the shock there were tremors. Miners 600 feet below the surface felt the shock severely and some became sick. Miners at 150 feet noticed the shock less. The area of disturbance is estimated at 1,200 by 600 miles. In Fronteras Valley, Sonora, old Mexico, and the neighborhood, the shock was destructive to houses and to human life. Fissures north and south were produced. The center is probably south of Fronteras. At San Bernardino Ranch, 90 miles southeast of Tombstone, all the houses were thrown down. There are extinct craters at this place.

1887. May 3;

Los Angeles. Tremor recorded on the magnetic instruments of the U. S. Coast Survey Observatory. Dr. Schott's determination of the time is 2h. 14.7m. p. m., P. s. t. (His report of June 20, 1887; copy furnished by U. S. Geological Survey.)

1887. May 4; II.

Slight shock recorded on seismometer at Lick Observatory.

1887. May 12;

Heavy shock at Petaluma.—A. S.

1887. May 23;

Severe shocks at Lakeport.—A. S.

1887. June 3; 2:48 a. m.

Carson (Nev.), S. W. and N. E. (VIII). Very severe, lasting 6 to 7 sec.; rotary motion, preceded by a noise like thunder. Stone and brick walls cracked, etc.

1887. June 9; 9:04 p. m.

Humboldt Light Station. Light shock.—*Letter from Naval Secretary L. H. Board.*

1887. June 18; 1:20 a. m.

Carson (Nev.), two light shocks.—C. W. F.

1887. June 24; 9:20 a. m.; V.

Cape Mendocino Lighthouse. A single heavy shock, stopping the clock at 9.20 a. m., and lasting two seconds. No damage was done.—*Letter from Naval Secretary L. H. Board.*

1887. June 24; 9:20 a. m.; VI.

Humboldt Light Station. Clock was stopped.—*Mss. of L. H. Board.*

1887. July 1;

Cape Mendocino L. H. 10.25 p. m. Light shock.—*Ibid.*

1887. July 6; 10h. 15m. 10s. p. m.; V.

Recorded on seismometer at Lick Observatory. Sudden shock lasting not more than five seconds. Direction northwest and southeast. Amplitude $\frac{1}{20}$ of an inch. The exact time of the shock was noted by Mr. J. E. Keeler.

1887. July 8; 4 to 7:30 p. m.

An examination of the Coast Survey tidal register for July, at Saucelito, shows that at 4 o'clock p. m. on the 8th of July a sharp earthquake wave entered the harbor of San Francisco. The waves gradually grew smaller, and disappeared at 7.30 p. m.—*S. F. Bulletin.*

1887. August 13; 3h. 17m. a. m.; VI.

"A very severe shock" at Point Pinos Light Station; duration of shock, eleven seconds.—*Letter of Naval Secretary L. H. Board.*

1887. August 13; 6:55 p. m., standard time.

Santa Cruz Light Station.—*Letter of Naval Secretary L. H. Board.*

1887. August 17; 4:01 a. m.; IV.

Slight shock at Fort Point Light Station, Presidio, San Francisco, Cal.—*Letter of Naval Secretary L. H. Board.* 3h. 57m. a. m., lasting three seconds.—*S. F. Bulletin*, August 18, 1887.—E. S. H. 4 a. m., San Mateo (IV).

1887. August 19; 1:02 a. m.

Berkeley, Cal.—Very distinct shock, S. E. to N. W., reported by Professor Soulé, University of California.

1887. August 24; III.

San Diego felt two slight earthquakes yesterday.—*S. F. Bulletin*, August 25, 1887.

1887. September 9; 3:58 p. m.; I.

Single shock in S. F., Cal. ? Somewhat doubtful.—E. S. H.

1887. September 19; III.

Mariposa; light earthquake accompanied by heavy rumbling noise. —*S. F. Bulletin*, September 20th.

1887. October 4;

Keeler, Cal., 2 shocks, 3.45, 3.46 and 3.49, standard time. W. to E. —U. S. Signal Service Observers.

1887. October 12; 12h. 55m. a. m.; V.

Recorded on seismometer at Lick Observatory. Not so heavy a shock as that of July 6th, but sufficient to waken sleepers. It was felt at Smith's Creek, at the foot of the mountain. Direction, northwest and southeast.

1887. October 18;

Large meteor, moving from east to west; with earthquake at Gilroy.—A. S.

1887. October 19; 6:17 a. m.; III.

Slight shock at San Francisco.—K. J. Petaluma, 6.15 a. m.—*S. F. Evening Post*, October 19th. Berkeley, Cal., 6.20 a. m.—Prof. Soulé. Vallejo, Napa County, 6.20 a. m.—*S. F. Chronicle*, October 20th.

1887. November 25; 4 p. m.; II.

Slight shock recorded on seismometer at Lick Observatory.

1887. December 3; 10:30 a. m.

At Point Arena Lighthouse.

1887. December 3; 10:55 a. m.; V.

Mendocino, Cal. A shock, ten seconds long, at 10.55; another, short and sharp, at 11.20. At Ukiah, the times are reported as 10.50 and 11.10. At Ukiah no damage was done, though some clocks were stopped. San Francisco papers of December 4th.

1887. December 4; 4:30 a. m.

Very slight tremor at S. F., Cal. (II).—E. S. H. At Haywards (VI) a sharp shock, waking many persons from sleep.—*S. F. Chronicle*, December 5, 1887. At 5 and 7 a. m., destructive shocks in Calabria, Italy.

1887. December 5; — a. m.; V.

A sharp shock at Petaluma.—*S. F. Chronicle*, December 7, 1887.

1887. December 6; 3 a. m.; V.

Severe shock at Mendocino, Cal.—*S. F. Chronicle*, December 7, 1887.

1887. December 6; between 6 and 7 p. m.

A very light shock in San Francisco, felt by several persons.—E. S. H.

1887. December 7; shortly after 7 a. m.; I.

Very light shock, San Francisco.—E. S. H.

1887. December 7; about 2:30 p. m.; I.

Very light shock, barely strong enough to be recorded on the seismometer of the Lick Observatory.

1887. December 16; 4:15 a. m.

Point Arena Lighthouse, 3 severe shocks (probably VIII).

1887. December 16; 4:28 a. m.; 8:40 a. m.

Mendocino, Cal., two shocks.—Oakland *Enquirer*, December 16.

1887. December 25; midnight; V.

"Quite a violent shock" at Santa Rosa, Cal.—*S. F. Chronicle*, Dec. 27, 1887.

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Walla Walla (W. T.), December 9, 1887.—Several years ago a loud explosion somewhere in the Salmon River Mountains shook the whole country there, and reports of a volcano breaking out and lava flowing over the mountain trails astonished the country. The San Francisco *Chronicle* and Portland *Oregonian* sent reporters there, but neither could find any trace of a volcano, though whole forests were ablaze. Joseph Baker, of Mount Idaho, an old miner, reports to the Walla Walla *Statesman* to-day that he has discovered the scene of the explosion, near some new diggings. The country for half a mile around is full of fissures newly cracked, but there are many others covered with moss, denoting previous explosions.—*S. F. Chronicle*, December 10, 1887.

The place is only twenty miles from Mount Idaho.—*W. W. Statesman*, December 9.

1879 to 1887.

I am informed that between the building of the narrow-gauge railroad through the Santa Cruz Mountains (1879) and 1887, October, there has never been any damage to the tracks from landslides, etc., which has been attributed to earthquakes. This would show conclusively that no very severe shocks have occurred.—E. S. H.

1871-1887.

There has never been any damage to the roadbed of the narrow gauge railroad, from Saucelito to Russian River (Duncan's Mills), which has been attributed to earthquake shocks.—Verbal account of W. F. Russell, Esq.

EARTHQUAKES ON THE PACIFIC COAST, 1888.

1888. January 7; 10:25 p. m.

S. F. (II): Berkeley (IV),—at Berkeley a loud explosion.—Professor Kellogg.

1888. January 13; at night.

Berkeley, a slight shock (N. E. to S. W.) recorded on duplex seismometer (I? II? III?).—Professor Soulé. [Carson City, 7.33 p. m., S. W. to N. E.??]

1888. January 16; 11:39 p. m.

S. F.: single, short, sharp shock (IV).—E. S. H. (I have no other report of this, and it must therefore be regarded as doubtful.)

1888. January 17; 10:10 p. m.

S. F.—E. E. Barnard. Oakland, from N. E. to S. W. (III? IV?).—Professor Edwards.

1888. January 26?

Healdsburg, 10 sec. duration, *S. F. Chronicle*, Jan. 28. (Total eclipse of the moon on January 28.)

1888. January 29; 10:35 p. m.

Carson, Nevada, a slight shock (IV to V). Grass Valley, Cal.: the same shock (II).—*Grass Valley Tidings*, Feb. 3. Carson 10.45 p. m., S. W. to N. E. (III).—C. W. F.

1888. January 30; 4:15 a. m.

S. F. [not reported in newspapers.]—J. R. J.

1888. February 1; 4 a. m.

Point No Point Lighthouse, Washington. A slight shock.—Ms. kindly communicated by U. S. L. H. Board.

1888. February 18; 2:50 a. m.

Fort Bragg: three severe shocks (V?); the first at 2.50, the others at intervals of one or two minutes. Mendocino: three shocks; the first at 2.55, the others at intervals of three or four minutes. —(*S. F. Bulletin*, February 18.) Point Arena Lighthouse, 2.35 a. m., W. to E. A violent shock (VII?).

1888. February? about 4 a. m.

Menlo Park: sleepers waked (V or VI).—J. T. Doyle.

1888. February 29.

Mare Island Lighthouse, 2.50 p. m. Duration 2 seconds. Light shock. Point Reyes Lighthouse, 2.35 p. m. Severe shock (VII?). (Ms. communicated by U. S. Geological Survey.)

1888. February 29; 2:51 p. m.

S. F.: on Montgomery Street, people alarmed (V); Pine and Mason streets, more severe (VI); Washington and Mason streets (VI). Two waves on duplex seismometer (917 Pine Street). The motion of the earth was

a—N. 68° W. to S. 68° E. *b*—S. 56° E. to N. 56° W.

The shock *b* was most severe.

Berkeley: not felt, not registered.—Oakland: (II.)—Belmont: not felt.—San Rafael: (IV or V) 2.48 p. m., E. to W.—Santa Rosa: 2.55 p. m., violent; people ran out of houses (VI).—Petaluma: 2.55 p. m., walls cracked (VII), sound of an explosion heard. The severest for many years.—Healdsburg: 2.44 p. m., light N. to S.—Martinez: 2.45 p. m., two shocks one minute apart (VI).—*S. F. Alta*, *Chronicle*, *Bulletin*, Feb. 29th and Mar. 1.

1888. March 7; 7:54 a. m.

Pasadena: 7.58 a. m. (VI); from N. W. to S. E., duration three seconds.—East Pasadena, 7.54 a. m., N. W. to S. E.—Los Angeles:

a little after 8 a. m. (VI)? "severest for 18 years; no damage to buildings," no very heavy articles overturned (VI). [Note: on 1883, Sept. 5th, a shock (VI) was felt at Los Angeles.—E. S. H.] —San Diego: scarcely felt (II). (*Pasadena Daily Star;* also *S. F. Alta, Chronicle,* Mar. 7, 8.)

1888. March 28; 1:41 a. m.

S. F.: slight shock, but sufficient to awaken a sleeper (V). Direction of shock nearly N. and S., on duplex seismometer, 917 Pine Street. Professor Davidson says duration ¾ second, and shock from W. to E.—*S. F. Bulletin,* Mar. 29.

1888. April 9; 7.50 a. m.

Riverside: slight shock (IV) N. E. and S. W. (*S. F. Bulletin,* April 9, *Chronicle,* April 10.)

1888. April 12; about 5:15 a. m.

Riverside: the shock sufficient to waken sleepers (VI), with loud noises accompanying. Colton, 5.30 a. m. (*S. F. Chronicle,* April 13.)

1888. April 13; 7:33 p. m.

Carson (Nev.), S. W. to N. E. Light.—C. W. F.

1888. April 28 [8:45 p. m.].

On the Lick Observatory seismograph an earthquake record was found April 29. From the trace of this shock the following data are taken. The dimensions given below are to be divided by 3.3 for the horizontal and by 1.6 for the vertical components, to get the actual earth movements. The times are given in seconds after a zero epoch arbitrarily assumed. The pen which marks the W. and E. components registered a line $\frac{4}{10}$ of a millimeter wide throughout. There appear to be widenings of this line as early as fifteen seconds before the zero adopted, but the amplitude of E. and W. tremors is never more than $\frac{6}{10}$ of a millimeter during the whole shock and the time of their beginning cannot be fixed. I presume we have here a case where the normal vibrations were strictly in an E. and W. plane. The transverse vibrations which arrived later are therefore N. and S. and of their full size in the diagram. We may then dismiss all further consideration of the E. and W. wave. It had scarcely a measurable amplitude. At 0 seconds the N. and S. tremors begin to show; the whole record of the vertical component is lost till 17 seconds.

At 3	sec. the earth moved	S.	of the neutral line	1 mm.
5	"	N.	"	1 "
6	"	S.	"	1 "
9	"	S.	"	1 "
10	"	N.	"	1 "

At $11\frac{1}{2}$ sec.	the earth moved	S.	of the neutral line	1 mm.
13	"	N.	"	1 "
15	"	S.	"	¾ "
16	"	N.	"	½ "
18	"	S.	"	½ "
19	"	N.	"	½ "

and small tremors with a double amplitude of about ½ mm. (on the trace) continue till 66 seconds.

The vertical component as recorded by the machine is given below:

At 18 sec.	the earth moved	above	the neutral line	1 mm.
19	"	below	"	½ "
21½	"	above	"	½ "
23	"	below	"	1 "

and tremors of not more than ½ mm. continue on the trace till about 56 seconds.

We may assume for a basis of computation:

Number of waves in 10 seconds = 4.
Period, about 2.5 seconds = T.
Amplitude magnified, 1 mm. $a = 0.3$ mm.

$$\text{Velocity of projection} = V = \frac{2\pi}{T} = 0.75.$$

$$\text{Intensity} = \frac{V^2}{a} = 1.90,$$

which corresponds to about I on the Rossi-Forel scale. The period of these waves is very slow.

1888. April 28; 8:48 p. m.

Reno (Nevada), a smart shock: three waves in 3 sec., followed by a general trembling for 10 sec. The time of the third and severest shock was 8h. 48m. 38s. p. m. Direction S. to N. (letter from U. S. Surveyor-General Irish). Two other observers say W. to E.—Grass Valley: felt in the Idaho mine below the 1600 ft. level, *Alta*, May 2d. Very heavy, lasting 5 sec., from E. to W. (*Chronicle*, April 30).—Grass Valley: the Orleans mine was flooded. The shock was at 8.45 p. m. and very heavy (VII). It was preceded by a loud noise. The duration was about 5 sec., and the wave was E. to W. Clocks stopped, plastering fell, and also tops of chimneys.—Nevada City: walls of courthouse cracked (VIII).—Wellington (Nev.), two slight shocks in quick succession, 8.55 p. m.—at Marysville, Downieville, Truckee, Colfax and Sacramento the shock was very strong (G. V. *Tidings*, April 30, May 2).—Nevada City: two severe shocks at 8.48 p. m. preceded by a deep rumbling sound. Direction N.—Dutch Flat; 8.46 p. m., severe from S. to N. People were badly frightened.—Stockton: four shocks at 8.40, from N. to S.—Dixon, 8.45 p. m.—Biggs: heavy shock "lasting 75 (?) seconds" [seven to five? E. S. H.], at 8.45 (VII), plastering cracked, etc.—Santa Rosa: slight shock at 8.45,

N. and S. (III).—Truckee: 8.47, duration two seconds (*S. F. Examiner*, April 29.)—Oroville: 8.45 p. m. Short, quick shock.—S. F. barely perceptible in third story of 917 Pine Street. No record on duplex seismometer in basement (I). Carson, 8.47 p. m., S. N., (IV), lasting 5 to 6 sec.—C. W. F.

1888. April 30; about 4 a. m.
Grass Valley: *Tidings*, April 30.—Downieville, 3.40 a. m., two light shocks (IV), (*S. F. Bulletin*, April 30).

1888. May 4; 1:55 p. m.
S. F., 917 Pine Street, decided shock, not registered on duplex seismometer, J. R. J.—S. F., slight shock (II) of a few seconds' duration (*Bulletin*, May 4).

1888. May 6; 9h. 42m. 22s. p. m.
Lick Observatory: sudden shock (III) E. S. H., preceded by a rumbling noise (Porcher). (Registered on duplex seismometer.)

1888. May 27; 1:50 a. m.
Carson (Nev.), S. N.; light, followed by quite a heavy shock 20 sec. later.—C. W. F.

1888. July 6.
Wellington (Nev.), 5.25 p. m. A slight shock.

1888. July 11; at night.
Susanville: slight shock (IV??), S. F. *Bulletin*, July 13.

1888. August 13.
Wellington (Nev.), 2.50 p. m. A slight shock.

1888. August 14; 9:57 a. m.
S. F., 917 Pine Street. Intensity (II) on R. F. scale. The duplex seismometer gives a looped trace on the plate (magnified four times) 7 mm. N. N. E. to S. S. W. (direction of first shock), 4 mm. at right angles to this.—Lick Observatory: direction on the plate N. N. E. The trace is a wavy line (magnified four times) 8 mm. long. N. N. E. and S. S. W. with six waves 1 mm. high at right angles to this. Probably the shock was nearly vertical here.

1888. September 10; 1:53 a. m.
S. F., 917 Pine Street: slight shock (II) not registered on duplex seismometer, J. R. J.—Oakland: slight shock, C. Burckhalter. Three shocks at 1.50 a. m. in quick succession, attended by noise; windows did not rattle (III?), Dr. Trembley. It waked sleepers in Oakland (V?), E. Booth.—Berkeley: slight.

1888. September 15?
Lick Observatory: the seismograph started at 6.15 a. m., but as the record was not like that of a shock, Mr. Keeler (in charge of the instrument) supposes the tremor which started the instrument to have been due to a high wind.

1888. September 17; 3:51 a. m.

Lick Observatory: The seismograph gives the following records (magnified 1.6 times for the vertical, 3.3 times for the horizontal components). At 3 seconds after an assumed zero second, the vertical component began its trace with a wave of period about 1½ seconds. The amplitude (on the trace) is hard to estimate, but is probably not less than 5 mm. for the first semi-wave, then about 1 mm. for a full wave, and after this mere tremors until about 40 seconds. The N. and S. component (magnified) was as follows:

At 4.3	seconds the earth moved	S.	of the neutral line	5 mm.
5.7	"	N.	"	2
5.9	"	on to	"	—
6.1	"	N.	"	2¼
6.4	"	S.	"	1½
6.9	"	N.	"	1
7.5	"	S.	"	1½
8.9	"	N.	"	1¾

and tremors occasionally as large as ¾ mm. continued until about 40 seconds.

The E. and W. component (magnified) was as follows:

At 4.3 seconds there was strong movement of the earth west of about 3 mm.; this was followed by a wave of period about 1 second double amplitude 2 mm.; and this again by another of period ¾ second double amplitude 1 mm. After this tremors continue for about 30 seconds.

The strata of which Mt. Hamilton is composed lie at a high angle to the horizon and the direction of the stratification is nearer N. and S. than E. and W. The earthquake instruments are at the very summit of the mountain. This may account for the fact that (at least for the shocks so far observed) the vertical component is relatively large, and that the N. and S. component (in the general direction of the stratification) is usually far larger than the E. and W. component.

We may then assume as a basis of computation for this shock:

Number of waves in 10 seconds = 6 or 7, say 6½.
Period, T, of the representative wave = 0.5 sec.
Amplitude of the representative wave (magnified) = 2.5 mm.
$a = 0.8$ mm.

$$\text{Velocity of projection} = \frac{2\pi a}{T} = 10.0.$$

$$\text{Intensity} = \frac{V^2}{a} = 126.$$

This corresponds approximately to V-VI on the Rossi-Forel scale, according to the table in the *American Journal of Science*, June, 1888, p. 429, which was derived from Japanese shocks.

Chabot Observatory: the time of the shock is 3h. 50m. plus or minus one quarter of a minute (W. Ireland, Esq.). It is registered on the duplex seismometer plate as follows. The first motion (of the pen, magnified four times) is 2 mm. to the W., then follow several small tremors towards the S. E. The motion of the earth is of course in the reverse directions.—Lick Observatory, 3.51 a. m.: severe shock, lasting several seconds. Strong vertical component (VI to VII) observed by E. S. H. Also on L. O. seismometer.—Gilroy, sharp shock: Santa Cruz, heavy (*S. F. Call*, Sept. 18).—S. F., 917 Pine Street: very slight, no record on seismometer, J. R. J.

Santa Cruz Lighthouse. Duration about 3 seconds. A very light shock. (Ms. kindly furnished by the U. S. Geological Survey.)

1888. September 23; about 11:30 a. m.

S. F., 917 Pine Street; very slight shock, J. R. J.

1888. October 3: 12:52 p. m.

San Miguel, S. L. O. Co.: light shock, 2 sec. duration, N. to S. (III). Another at same place at 1.02 p. m., quite severe, N. to S., 4 sec. duration, no damage done (VI?), *S. F. Chronicle*, Oct. 4.

1888. October 4; p. m.

Paso Robles: slight shock.—*S. F. Report*, October 5.

1888. October 4; 11 p. m.

San Diego.—*S. F. Bulletin*, October 5.

1888. October 5; 4h. 41m. 30s. ± 10s. a. m.

Chabot observatory: the shock was sufficient to waken a sound sleeper (VI). On the duplex seismometer plate the trace begins with a tremulous motion toward the W., followed by two sharp jerks to the S. The motion of the earth is contrary to the motion of the plate.

1888. October 23? 24?

Lick Observatory: During Mr. Keeler's absence the earthquake instruments were in charge of Mr. Hill. On October 23, at 6 p. m., I noticed that the earthquake instruments were in their usual state. I also noted at 9 p. m., October 24, that a shock had occurred previously. The clock dial of the earthquake clock is divided to 12 hours (instead of to 24 hours as it should have been), and there is an ambiguity of 12 hours in the time of the shock, which is either—

1888. October 23; 11h. 42m. p. m., or October 24, 11h. 42m. a. m.

The shock was sufficient to start the clock of the Ewing seismograph, but the plate did not move. The duplex seismometer plate shows a tremulous wave in the direction N. E. and S. W.

1888. October 24; 2:50 a. m.

East Oakland: (V) Mr. Blinn's Observatory. The duplex seismometer plate shows a trace from S. to N. in general direction. The first trace on the plate is that of a single wave about 2m. in amplitude (magnified four times) followed by small tremors.—Chabot Observatory: the plate of the duplex seismometer shows the first wave strongly towards the N. E. The trace of this wave (magnified four times) is a straight line 6 mm. long. This is followed by two waves of the earth as it regained its original position. The motion of the earth is contrary to that of the pen on the plate.

1888. October 25; in the night.

Mr. Blinn's Observatory. The duplex seismometer gives a tremor, and the general direction of the trace on the plate is S. E. to N. W.

1888. November 4; 3:36 a. m.

Lick Observatory (VI).—E. S. H. Mr. Barnard gives the time as 3h. 37¼m., plus or minus ½m. The duplex seismometer gives a very complex knot of curves ending by a trace on the plate towards the S. W.

1888. November 18; 2:28 p. m.

S. F., 917 Pine Street: two shocks north and south (VII) registered on seismometer. Another light shock at 5.38 p. m.—J. R. J.—S. F., 2h. 26m. p. m. Sharp vertical shock, duration 4 seconds.—T. T.—San Rafael: 2.30 p. m., N. and S.—Oakland: 2.29 p. m.; one chimney fell (VII?).—Berkeley: 2.28 p. m.; duration 7 sec.; a third shock at 5.35 p. m. (*S. F. Examiner*, Nov. 19.)

Lick Observatory: not felt, not registered.—Chabot Observatory: 2h. 27m. 53s., very sharp shock; 3.30, slight; 5h. 37m. 20s., sharper than the second shock. The duration was 3 sec. The trace on the duplex seismometer is a very complicated circular knot of 5 to 6 mm. diameter (magnified four times) with a looped excursion of the pen toward the east 6 mm. from the center of the knot, and another straight one from the center to the W. S. W., also of 6 mm. All three shocks are on this single plate.—In Oakland no real damage was done. Two or three chimneys were overthrown and panes of glass were broken (VI, or VII?).—East Oakland: 2.29 p. m., N. to S., duration 2 sec.; 3.45 p. m., very light; 5.36 p. m., E. to W., duration 2 sec.—(*S. F. Bulletin*, Nov. 19).—Napa: 2.36 p. m., duration 10 sec.—*S. F. Chronicle*, Nov. 19.—Haywards, San Leandro, Niles: not felt.—Mr. Burckhalter.—Clear Lake: not felt.—Capt. R. S. Floyd.

It is also reported by Capt. Edmundson of the ship "Drumlanrig," that he found soundings of 35 fathoms, 35 miles S. W. of the Farallones where no shoal is now known to exist. It is supposed

by some that the shock of Nov. 18 may have produced this shoal which is not down on the charts.

East Oakland: Mr. Blinn's Observatory. The first shock was severe (VI), lasting about two seconds. The time was very approximately 2h. 27m. 57s. (Blinn). Mr. Irelan gives 2h. 27m. 54s. Trees and hedges were seen to move. A few light articles were overthrown, pictures were displaced, a clock was stopped (its pendulum was in the plane N. E. and S. W.); 5 chimneys were thrown down on 23d avenue; a noise was heard *after* the first shock. The second shock was (II) at 3.48 p. m. The duplex seismometer trace is a loop about 1 mm. in diameter. The third shock was (III) at 5h. 38m. 45s. p. m. The trace on the duplex seismometer begins in an ellipse 2 mm. E. and W., 1 mm. N. and S., and then there is a confused record of trembling 3 mm. N. W. and S. E. by 1½ mm. at right angles to this.

1888. December 11; 3:29 p. m.

Lick Observatory: the shock was sudden and (IV) in intensity. Time by watch 3h. 28m. 59s.; by earthquake clock 3h. 29¼m.—J. E. K. A humming noise was heard *after* the shocks. There were two such at an interval of 2 sec. The time of the last was 3h. 28m. 58s. plus or minus 3 sec.—E. E. B. Intensity (V), time 3.28.8.—E. S. H.

The duplex seismometer gives a record (magnified) beginning with a sharp straight trace to the N. W. 3 mm. long, then a straight trace to the N. E. 1¾ mm. long, then a straight trace to the N. W. nearly 2 mm. long, and at the end of this the pen has recorded a confused tremor in a space about 1 mm. square. The record of the Ewing seismograph is as follows: (The adjustment of the marking pen for seconds has been changed so that there are 95 beats of the pen to 1 min. of time.)

There are very slight *vertical* tremors for the first three beats; they then vanish completely. Their period is from $\frac{1}{8}$ to $\frac{1}{9}$ of a second of time; their double amplitude is not above $\frac{3}{10}$ of a millimeter.

The *east and west* vibrations last only for two beats, though the faintest perceptible tremor lasts until the twentieth beat after the beginning. Their greatest double amplitude is not above ½ of a millimeter, and their period appears to be about ½ a second.

The *north and south* vibrations are well marked. From the zero beat (beginning) until 1¼ beats there are marked tremors. From 1¼ beats to 4¾ beats vibrations having a double amplitude of about one-half a millimeter, and a period of about ⅛ to ¼ of a second time. At the end of the 6th beat the marked tremors cease and a very faint tremor continues to the end of the 20th beat, and possibly to the end of the 33d beat. As a basis of com-

putation we may assume from the record of the north and south component:

Double amplitude magnified 3.3 times = 0.5 mm.
$a = 0.08$ mm.
$T = 0\rlap{.}^{s}3$ seconds.

$$v = \frac{2\pi a}{T} = 1.7. \qquad I = \frac{V^2}{a} = 36.$$

This corresponds to about II on the R.-F. scale according to the paper cited above. The intensity was, however, IV or higher.

EARTHQUAKES ON THE PACIFIC COAST, 1889.

1889. January 19; 1:43 a. m.

Oakland: A slight shock recorded on the seismograph of F. G. Blinn (II).

1889. January 22; 7:51:58 p. m. (?)

Mount Hamilton: a very light shock suspected by C. B. Hill (I?). No record was found on the seismographs.

1889. February 6; 9:20 p. m.

Southern California: a distinct shock at 9.25 p. m., shaking buildings and causing people to run into the streets. Vibrations from north to south, lasting about ten seconds (VI). San Bernardino papers. Colton: Two distinct shocks at 9.20 p. m. Los Angeles: slight shock at 9.25 p. m. Shock accompanied by distinct dull rumbling. Post office clock at San Bernardino stopped at 9.20.30, subject to an error of five or six seconds (VI). The clock faced the east. W. C. Parmley, San Bernardino. At Kodiac Island earthquake waves were recorded from February 5, 9 p. m., to February 6, 7 a. m.

1889. March 16; 2 p. m.

Point No Point Lighthouse, Washington. A slight shock.—U. S. L. H. Board.

1889. April 3; 2:29 a. m.

Mount Hamilton: a slight record was made on the Ewing and duplex pendulum seismographs (II). The greatest motion was from north to south, a very slight motion from east to west, and the vertical component was imperceptible. The maximum (magnified) amplitude was about one-fourth millimeter, and the period of a vibration about two-thirds of a second; hence the computed intensity is 7.0 or (I) by the Rossi-Forel scale. This shock was not felt by anybody at the observatory. The time given is that recorded by the seismograph clock.

1889. April 14; 7:28 p. m.

Central California: Lick Observatory, time of ending 7.27.56 (E. S. Holden), 7.28¼ (E. E. Barnard). Felt by many persons at the observatory, but not by all. Recorded on both seismographs (III).

The curve representing the north and south motion on the Ewing seismograph begins with three quite regular waves of progressively diminishing amplitudes, the period of each being 1.25 seconds. The maximum (magnified) amplitude is 0.5 millimeter. The east and west curve begins with a series of small, irregular tremors, followed by two marked and fairly regular waves which begin about where the waves of the north and south curve end. Maximum (magnified) amplitude, 0.4 millimeter. The vertical motion is very slight. The marked vibrations on all the curves end at about ten seconds, but very slight undulations extend to about one and one-half minutes. It is hard to say how much of these is real. The intensity of this shock, computed from the data above given, is 4.0 or (I) of the Rossi-Forel scale.

San José, 7.27.30 (S. W. Burnham). San José, University of the Pacific: the record on the duplex pendulum seismograph at this place is considerably larger than that obtained at the Lick Observatory, and is very complicated. The San José *Times* says: "The shock was not severe, but was quite plainly felt by many people. A majority of people, however, were unconscious of anything unusual."

Santa Cruz: quite a severe shock, with quick, jerky motion from east to west, rattling the windows in loosely built houses. Time, 7.25. Probably the heaviest shock felt in Santa Cruz in four or five years, although many people on the first floor of well-built houses did not notice it.—*Santa Cruz Surf.*

An earthquake occurred at 7.30 p. m. The vibration was north and south and lasted several seconds.—Dispatches from Santa Cruz.

Centerville: slight earthquake at 7.34. Vibrations northeast to southwest.

Los Gatos: two slight but distinct earthquakes at about 7.15. Vibrations from south to north.

Gilroy: remarkably sharp but short earthquake at 7.25, making lamps, crockery, etc., rattle severely.

Merced: a heavy double-shock earthquake at 7.33. Oscillation, northwest to southeast, and about two seconds in duration.

Oakland: earthquake at about 7.28, not felt by all persons.—F. G. Blinn. The record on Mr. Blinn's seismograph shows about the same amount of motion as at the Lick Observatory.

1889. April 17; 8:32:38 p. m.

Mount Hamilton: noted by J. M. Schaeberle, while observing the collimation constant of the meridian circle. The wires vibrated through about 10 sec. Time noted, 8.32.40. Suspected in another part of the building by J. E. K. Time noted, 8.32.36. No perceptible record on the seismographs (I).

1889. April 17; 10h. 18m. p. m.

San Francisco: a slight shock, E. to W.

1889. April 20; 4 a. m.

University of the Pacific, San José: Prof Higbie sends a record obtained with his seismographs, showing a considerable disturbance. I have no other notices of this earthquake.

1889. April 24; 3:37 a. m.

San Francisco: " heavy earthquake shock occurred at 3.37 a. m. Vibrations from north to south."—Jenkins. Received at Washington Signal Office.

1889. May 1.

Lompoc: quite a heavy earthquake shock was felt here at 11.55 to-day. The vibrations were from east to west. No damage.

Susanville: at 9 o'clock a sharp earthquake. The vibration was north and south.

1889. May 19; 3:10 a. m.

Central California: at the Lick Observatory nobody was awakened, although the motion as registered by the seismographs was considerable. This is probably owing to the long period of the vibrations. The time recorded by the earthquake clock was 3:9.6.

The following letter was furnished by Prof. Holden to the California Associated Press:

Lick Observatory.—The earthquake was felt at the Lick Observatory at nine minutes past 3 o'clock this morning, as a series of gentle shocks of small amplitude and slow period. It was not severe enough to awake the sleepers. The extraordinary feature of this shock was its great duration, which is registered on our instruments for no less than two minutes and twelve seconds. In this feature it resembles the great Inyo shock of March 26, 1872, as experienced in San Francisco, and for a similar reason. The observing station was in both cases far removed from the origin of the shock, and the energy of the earthquake was manifested in long waves of slow period, but lasting for an unusual time. Moreover, in this case the shock was far more severe in Santa Clara Valley than after it had traversed several ranges of hills and reached Mount Hamilton. Our earthquake machine shows that the up and down movement lasted eighty-four sec-

onds. The period of each wave was about 1.7 seconds, which is very gentle and slow, and the double amplitude of the vertical waves was never more than 0.03 of an inch. The east and west movement consisted of strong tremors for nearly four seconds, when the waves began and lasted, as strong decided movements, for twenty-nine seconds, after which the tremors continued until their trace was lost. Ninety seconds after the beginning, the period of these waves is 0.8 of a second (very slow) and the double amplitude is about 0.03 of an inch. The most remarkable motions were in the north and south direction. The tremors were felt for three seconds, ten large waves for forty-five seconds, succeeded by tremors until one hundred and thirty-two seconds from the beginning. Their period was 0.6 of a second. The double amplitude is 0.05 of an inch. The duplex machine shows results agreeing with the above and indicates the very complex nature of the motion of the ground.

The vibration of greatest amplitude occurred only five seconds after the plate of the Ewing seismograph started, and is nearly as great in the east and west as in the north and south curve, while the vertical component is small. Paying due regard to the values of the different components, it appears that the maximum vibration (double amplitude) of the earth at the Lick Observatory was 2.2 millimeters, and the period being 0.6s. as stated above, the computed intensity of the shock is 120 or (V) of the Rossi-Forel scale.

Yerba Buena Island Light Station, San Francisco Bay; time, 3.14 a. m.: from eight to twelve seconds duration; one long, rolling shock with a sort of jumping motion also, but it still can only be called one shock; lighthouse clock did not stop; the motion was certainly from east to west; no damage.—J. A. F. McFarland.

Mare Island Light Station; time, 3.9.30 a. m.: observer was awakened. The shock was intermittent; door-bell rang in a house near by (VI).—Kate C. McDougal, light-keeper.

Berkeley: in the valleys the shock was more severe. The seismograph tracing of the university observatory at Berkeley shows a very complex curve, which can be roughly bounded by an ellipse 8 by 6 millimeters, with one great loop extending 7 millimeters farther (magnified four times). Duration 12 sec. Vibrations slow.

Oakland: the Chabot Observatory record has some resemblance to the above, but is larger, the bounding ellipse being 22 millimeters long, also with a loop extending toward the northwest. The mean-time clock of the Chabot University stopped at 3.01.44 (VI).—C. Burckhalter.

East Oakland: the record obtained at Mr. Blinn's observatory somewhat resembles that just described, and indicates a shock of

about the same intensity. Several loops extend about 20 millimeters from the center.

The shock lasted from five to twelve seconds, according to some persons, while others considered that the earth shook for fully a minute; motion great but gentle; two persons felt nausea; four regulators in jewelers' shops, on walls running west-northwest and east-southeast, stopped at about 3.10, two of them indicating 3.10.30 and 3.10.35 respectively. A clock with heavy mercurial pendulum on same wall was not stopped.—F. G. Blinn. Intensity = (VI).—William Ireland.

Three miles from Collinsville, in the region of greatest disturbance, houses rocked and pieces of plaster fell (VII); articles shaken from mantelpieces, etc.; chickens shaken from their perches; dogs barked; two chimneys demolished (VIII), and one had the upper part twisted 45 degrees; goods thrown from shelves in stores.—F. E. Booth, manager of Black Diamond Canning Company, in a letter to F. G. Blinn.

Mills College: in the seismograph record at this place there are great loops 80 millimeters long, which appear to have been produced by the swinging of the pendulum after the shock. It is necessary to give the seismograph pendulums some stability, but they are adjusted to swing in a long period, much longer than that of the ordinary earthquake shock. It is evident, however, that in an earthquake like this the vibrations might be nearly synchronous with those of the pendulum, which would thus be thrown into violent oscillations. In most earthquakes this is not likely to happen. Possibly the long loops in some of the other seismograph records may be due to the same cause.

San Francisco: No damage was done in the city. The newspaper accounts seem to be exaggerated. Motion from west-northwest to east-southeast.—J. B. Trembley.

Time of shock in San Francisco, 3.10.42.—Prof. Davidson.

Fort Point Light-Station: the shock was preceded and accompanied by a rumbling noise and lasted eight or nine seconds. The keeper felt three shocks, the first short and light, and about fifteen seconds later one more distinct; a minute afterwards, the last, which was a tremor. Doors were opened; windows and crockery rattled and people were aroused from sleep (VI?)

Lime Point Fog-Signal Station: time 3.10.32. Lasted about five seconds, and was accompanied with a noise like the rumbling of distant thunder.

Forest Hill: in the Mayflower mine no sign of an earthquake at 600 or 800 feet underground. Directly over the mine the shock was strong enough to rattle a wash-bowl against a pitcher.—S. E. Reamer, San Francisco.

San José, University of the Pacific: Prof. Higbie sends a record which shows about the same amount of motion as at Oakland, the greatest oscillations being northeast and southwest.

San Francisco: 3h. 15m. a. m. Sharp shock; rolling; duration 15 sec.—T. T. Various reports from the San Francisco papers are given below, the date being May 19.

At 3.12 a. m. Sunday morning a severe shock of earthquake was experienced here. It lasted twenty seconds and was followed by peculiar shivers continuing five seconds longer. The motion was from east to west, and the shock is said to have been the sharpest experienced here for the past fifteen years. Half of the door-bells in the city were set ringing, and glassware and mirrors damaged (VI).

Stockton: a heavy shock at 3.15 this morning. It lasted about ten seconds, with vibrations from north to south. A large number of people hurried into the streets. One man jumped out of a second-story window. A number of buildings were heard to crack, but no damage has been reported (VII).

Lodi: the heaviest earthquake that has been felt here for twenty years occurred at 3.15 this morning. The wave was north and south, and so severe that goods were shaken from shelves in one of the stores here, and dishes rattled in the houses.

Antioch: the most severe earthquake shock experienced since 1868 about 3.10 this morning. It shook off the tops of many chimneys in the town. The vibrations were from north to south. The entire population was aroused and many people in their night-gowns rushed into the streets. No serious damage is reported, but the harvest of broken crockery and glassware, cracked plaster ceilings and chimneys, is abundant (VII? VIII?).

Modesto: the people of this section were awakened by a heavy shock of earthquake at 3.15 this morning. The vibration was from north to south and lasted several seconds. The windows and doors rattled and chandeliers vibrated. A second shock, less pronounced, followed ten minutes later. No damage (VII).

Napa: the severest earthquake experienced here in twenty years occurred at 3.10 this morning. It lasted twelve seconds. No damage is reported beyond the cracking of plaster. The vibrations were from west to east (VII).

San Leandro: the heaviest shock of earthquake felt here for years at 3.11 this morning. The vibrations were from north to south and lasted about one minute.

Petaluma: this morning at 3.15 there were three distinct shocks. They followed each other in quick succession, the vibrations being from east to west. The second shock was exceedingly heavy.

Rio Vista: at 3.15 a. m. the most severe shock of earthquake since 1868, the duration of the shock being several seconds. People jumped from their beds, chickens were thrown from their roosts, and some chimneys were slightly damaged. The direction was from west to east (VII).

Newark: the most startling earthquake for many years was felt here this morning at 3.05. There appeared to be three shocks, vibrating from east to west.

Nevada City: three distinct and rather heavy shocks of earthquake were felt here this morning at 3.30. Their direction was from west to east.

Calistoga: an earthquake at 3.03 this morning. It was not remarkably heavy, but the vibrations, which were from east to west, continued longer than those of any earthquake felt in many years.

Vacaville: The shock this morning at 3.10 lasted fully half a minute. It was the most severe shock ever experienced here. The vibrations were from northeast to southwest.

Santa Cruz: quite a sharp shock was felt here at 3.20 this morning, vibrating from west to east.

Sacramento: an earthquake was felt here at 3.10 this morning. The wave came from the southeast and was quite severe. No damage.

Mountain View: a heavy shock, with vibrations north and south, was felt at 3.10 this morning. No damage.

San José.—The earthquake at 3.12 to 3.14 a. m., the wave seeming to pass from southeast to northwest. There was but one distinct wave, followed by a rumbling and a backward motion, due to the reaction.

Pleasanton: at 3.15 this morning the worst earthquake shock since 1868. The vibrations were north and south, and continued for fifteen seconds. They were so severe that buildings creaked and tottered (VII).

Haywards: a severe shock about fifteen minutes past 3 o'clock. It was strong enough to throw many out of bed, and lasted several seconds (VII? VIII?).

Los Gatos: three sharp earthquake shocks at 3 o'clock this morning. The first was much more severe than the two succeeding ones. The vibrations were north and south.

Fairfield: three heavy shocks in quick succession were felt here at 10 minutes past 3 o'clock this morning, vibrating east and west. They were the heaviest since 1868.

Woodland: there was quite a heavy earthquake this morning at 15 minutes past 3 o'clock. The vibrations were from east to west, and the duration about fifteen seconds.

Santa Rosa: three distinct shocks of earthquake in close succession, were felt at 3 o'clock this morning. The vibrations were from east to west.

Ione: many citizens were aroused at 3.10 this morning by an earthquake shock, lasting several seconds. The vibrations were north and south (VI).

Suisun: at 3.10 this morning a severe shock of earthquake was felt here, accompanied by a rumbling noise.

1889. May 26; 7:13 a. m.

Central California.—Lick Observatory: a very slight shock was recorded by the seismographs at 7.12 ± 1. The extreme motion of the earth's surface did not exceed 0.5 mm. The greatest disturbance was in a north and south direction, and the vertical component was very small. Although this shock was recorded on both instruments, it was not felt by any one on the mountain.

Period = two seconds, hence computed intensity = 2.5 or (I).

San José and vicinity: not felt.

San Francisco: 7h. 14m. a. m. Light shock, duration 1 sec.—T. T. A slight shock of earthquake was felt in this city on Sunday morning at thirteen minutes six seconds after 7. The vibrations lasted but two or three seconds and were east and west. (Time noted by Professor Davidson.)

Gonzales: a heavy shock of earthquake was felt here this morning at 7.15. The tremor lasted half a minute and made the large buildings quiver. The oscillation was from northeast to southwest.

Santa Cruz: quite a shock of earthquake occurred at 7.15 this morning, the wave being west to east. No damage was done, the shock being much lighter than the one a week ago.

1889. June 2; 5:54 p. m.

Humboldt Light Station: it lasted about seven seconds. No previous noises; but with the quake came a noise of rushing wind or sudden gust. I would class the quake as light. It rattled crockery, but did not throw anything off shelves. It indicated itself in an undulatory motion from west-southwest to east-northeast as marked by a wicker basket suspended from the ceiling which swung 15 degrees. The pendulum clock in light tower (pendulum 20 inches long) stopped at 5.54 p. m. sun time by almanac; the clock faces to west.—William C. Price, light-keeper.

1889. June 6; 4 a. m.

Oakland: a sudden shock lasting one second, followed by a rumbling noise lasting five or six seconds (II).—F. G. Blinn. A slight trace was made by the seismograph. Mount Hamilton—not felt or not recorded.

1889. June 6; 8:30 p. m.

San Bernardino: noticed by some persons, but not by all. A single shock from northeast to southwest, with some vertical motion. A few persons report rumbling noises. Times of occurrence vary somewhat; 8.14 given by one person. Estimated intensity (III). —W. C. Parmley. There was quite a shock of earthquake in this city last evening at about 8.30. The shock was accompanied by a low rumbling, and the vibrations were northeast to southwest. —San Bernardino, Daily *Times-Index*, June 7.

1889. June 9; 3:44:24 ± 3 p. m.

Mount Hamilton: very slight shock (I) noticed by J. E. Keeler, not by others. Vibrations lasted a few seconds. A small record was made on the duplex seismograph.

1889. June 10; 7:33:7 a. m.

Mount Hamilton: very slight shock recorded on both seismographs, but not felt by anybody (II). Measurement of the record on the Ewing seismograph gave the following data: Duration = twenty-four seconds; maximum double amplitude (magnified) east and west = 0.52 millimeter; maximum double amplitude (magnified) north and south = 0.38 millimeter; maximum double amplitude (magnified) vertical = very small; period of complete vibration = about one-half second. Hence computed intensity is 12 or (I) of Rossi-Forel scale.

1889. June 19; 10 p. m.

Lassen County, California, and Nevada: this shock, which does not appear to have been felt in the central and southern parts of California, is thus described in the Susanville *Advocate:*

Since the 19th instant the people of Susanville, Lassen County, have felt about seventy-five slight shocks of earthquake. The first shock occurred at 10 o'clock on the night of the 19th, and was the heaviest ever experienced in this section. The first great shock was followed at greater or less intervals by more or less heavy shocks for over two hours, until twenty-eight shocks had been recorded, of which the first, the thirteenth, the fifteenth, and the eighteenth were very severe. At the first shock, which was something fearful, rocking buildings from side to side and scattering crockery and glassware in all directions, people rushed out of houses with the costume, principally, that nature had provided for them (VII). The vibrations were from south to north, but apparently did not extend much north of Susanville. The shocks were generally preceded by distinct rumbling noises.

Chico: a slight earthquake shock was experienced here last evening about 10 o'clock. Vibrations from east to west.

Sacramento: at 10.12 last night a slight shock of earthquake was felt here. It lasted but a few seconds, and was felt by only a few persons.

Susanville: the heaviest earthquake ever felt here occurred at 10.05 last night, succeeded by lighter shocks at short intervals during the entire night.

Downieville: there was an earthquake last night at 10.07 lasting about a minute. The weather is warm. The mercury this afternoon marked 90 degrees.

Grass Valley: an earthquake was felt here at 10 o'clock last night. The shock was quite heavy.

The following is part of a letter to the San Francisco *Call:*

The series of earthquake shocks that commenced here on the evening of the 19th inst. have been continued at intervals up to the present. Although the first shock was by far the hardest, there have been a number since that have made things quite lively. Reports from different localities within a few miles of here point to the fact that this place, Willow Creek, and Eagle Lake appear to be the centers of the disturbances, the surrounding country being less disturbed. The section named above could be included in a circle twenty-five miles in diameter. Since the first shock some curious phenomena have been developed. The spring from which the town of Susanville is supplied with water has been largely increased in its volume of water, as also many others in this vicinity. The waters are of a milky whiteness. The water of Eagle Lake has been greatly disturbed and is quite muddy. At the south of Eagle Lake and extending many miles is a range of high volcanic hills. A number of persons who were near or on these hills last Friday heard loud rumblings to the west, accompanied by loud detonations like the firing of very heavy artillery, while the earth seemed to keep up an almost uninterrupted trembling motion. A slight trembling is also noticed much of the time here in town. A farmer in Willow Creek Valley, and who was at work in a large irrigating ditch at the time of one of the recent shocks, had the water thrown out of his ditch, so violent were the oscillations of the earth. A chimney in the house of S. Knudson, in Willow Creek, was thrown down by the first shock. (VII? VIII?).

San Francisco: news from Susanville in the Sierra Nevadas says slight earthquake shocks continue, and that the people have become so accustomed to the constant trembling of the earth that they pay no attention to it.—S. F. papers.

Carson City, Nevada: Prof. C. W. Friend sends a seismograph record which shows a maximum motion of 5 millimeters (magnified four times about equally distributed in all azimuths (10.00 p. m., S. N., light).

1889. June 20.

Sacramento: a shock.

Susanville: A continuation of the earthquake shocks. "There were earthquake shocks at intervals the entire day after the first heavy shock during the night. The upper heavens were filled with small meteors."—*S. F. Chronicle*, June 22.

1889. June 20; p. m.

University of the Pacific, San José: the seismograph record shows vibrations of about 3 millimeters in an east and west direction and 1.5 millimeters in a north and south direction (both magnified).

1889. June 24; about 4 a. m.

University of the Pacific, San José: the record sent by Prof. Higbie indicates a shock of about the same intensity as the preceding one, with vibrations in about the same direction.

1889. June 25; 3 a. m.

San Diego: "Dr. Eigenmann reports an earthquake at San Diego at 3 a. m., June 25."—*West American Scientist*, August.

Carson City, Nevada: a seismograph record, marked "during night, June 25-26," is sent by Professor Friend. The vibrations are west-northwest and east-southeast, and indicate a shock of intensity (III).

1889. June 27-28; during night.

Carson City, Nevada: a slight shock recorded, with vibrations in same direction as the preceding one.

1889. June 30; between 8 and 10 a. m.

Carson City, Nevada: (II) or (III).—C. W. Friend.

1889. July 2-3; during night.

Carson City, Nevada: slight shock recorded (II?).

1889. July 3.

Oakland: 4.45 a. m. and 5.02 a. m. and also 6.30 p. m.—Cal. S. W. Service Annual Review.

1889. July 4; 8:05 a. m.

Carson City, Nevada: slight shock recorded. About the same as the preceding.

1889. July 4-5; during night.

Carson City, Nevada: record larger than the last, but pen did not return to starting point. Magnified motion perhaps 3 millimeters.

1889. July 6-7; during night.

Carson City, Nevada: record shows (magnified) motion of 4 millimeters in direction west-northwest and east-southeast.

1889. July 9-10; during night.

Carson City, Nevada: slight shock. In all these records the principal motion is west-northwest and east-southeast.

1889. July 10; and preceding days.

Arroyo Grande, San Luis Obispo County: the following report is from the San José *Times:*

The territory around Los Olivos has been troubled with an earthquake the past few days. Sunday there were six distinct shocks, one of which rattled the dishes off the shelves. The hardest shock took place at 3 o'clock this morning. The druggist at Santa Ynez has removed his bottles from the shelves to the floor. Four years ago a burning volcano was reported at Lookout Mountain, on the south side of Santa Maria valley, which was decided to be a burning asphalt bed.

1889. July 25; 10:8 p. m.

Mount Hamilton: sharp shock. Rattled pictures on the wall. Time, 10:8.2 (V).—E. S. H. A light quivering shock, followed by a severe shock, shaking the observatory building, at 10.7.59.—E. E. B. Time, 10.7.59.—J. M. S. Time, 10.7.58.—C. B. H. Generally felt by those on the mountain who were awake and not engaged in some occupation which would disturb the attention. It did not seem to me as strong as others we have had (IV).—J. E. K.

Record obtained on both seismographs. The Ewing machine shows maximum (magnified) double amplitude = one millimeter in north and south direction, with period = one-third second. Corresponding east and west motion very small, and vertical component hardly perceptible. The vibrations are almost indistinguishable at fifteen seconds after the time of starting of the plate. The duplex pendulum record agrees well with this, but shows a slightly greater amplitude (magnified four times, about 2 millimeters). The computed intensity is 53 or R.-F. (II-III).

1889. July 31; 4:46:45 a. m.

Central California, Mount Hamilton: shock wakened sleepers. Time 4.46.45 a. m. (V).—E. S. H. Awakened from sleep. Time, as nearly as could be ascertained, 4.46.50 a. m.—J. E. K.

Measurement of the record made by the Ewing seismograph gives the following data:

Extreme duration, 30 seconds.

Greatest motion, north and south (double amplitude), 1.3 millimeters (magnified).

Motion east and west, a little less.

Vertical motion very small.

Period of wave = about 0.3 second.

Computed intensity = 88 = (IV +).

The duplex pendulum seismograph gave a record in close agreement with the above.

Mare Island Light Station: time 4.48, navy-yard time.—Was awakened from a sound sleep. There was a rattling of bowls and pitchers. I felt two shocks: that is, one that was continuous and a sudden heavier impetus in the midst of the general shaking. It was sharp, severe, and quick, and more vertical than that of May 19.—Kate C. McDougal, light-keeper.

Santa Cruz Light Station. Time, 4.45 standard time.—One tremulous shock lasting about three seconds.—Laura J. F. Hecox, light-keeper.

Fort Point Light Station. Time, 4.47.—One shock lasting about twelve seconds, an undulating movement from east to west, unaccompanied by noise. The clock in the tower almost stopped, but recovered itself. It faces south-southeast.

Oakland: the shock appears to have been very much more severe than at the Lick Observatory. The magnified record at the Chabot Observatory shows irregular vibrations distributed in all azimuths over a circle about 8 millimeters in diameter, with irregular loops running out about 18 millimeters from the center. These may be due to swinging of the pendulum. Time, 4.45.30. Duration, twenty seconds. The pier of the 8-inch equatorial telescope was cracked near the top, where it was 40 by 15 inches in cross-section, and the south side was shifted one-sixteenth inch toward the east, the north side remaining in position. The pier is of brick. The ferry clock at the foot of Market Street, San Francisco, stopped at 4.47.20. (Error ± 3 seconds). The clock in the ferry-house at Oakland pier stopped 4.46.30; error unknown.—C. Burckhalter. (VI.)

Oakland: the first shock seemed to be from northeast to southwest, and was attended by three distinct, loud, sharp reports, followed by a rattling noise which gradually died away. No vibration of pendant objects, but rattling of windows for a longer time than I had ever before noticed.—J. B. Trembley.

East Oakland: at Mr. Blinn's observatory the record showed an indistinguishable mass of lines about 4 millimeters in diameter, with many loops roughly distributed over a circle about 18 millimeters in diameter, and finally a number of great loops extending as much as 35 millimeters from the center. The last are certainly due to swinging of the pendulum. They extended mostly in an east and west direction. Fully (VI).—F. G. B. Time about 4.47. A fresh plate was substituted immediately after the heavy shock, but the two subsequent lighter shocks made no record, and I did not feel them. They are described as being vertical and momentary.—F. G. Blinn. The first shock awakened me at 4.46.34, which must have been very nearly the time of beginning of the earthquake. Time of ending noted by Mr. A. S. Ireland at 4.46.45. The second shock occurred at 4.54.59, and was

quite slight, lasting only about three seconds. The correction of my watch was determined by transit observations by Mr. Blinn, shortly after the shocks occurred.—Wm. Ireland.

Berkeley: at the University observatory a diagram was obtained showing the effect of both shocks. The greatest oscillations are in an east and west direction. (About 13 millimeters, magnified, but the pen did not return to the starting point, stopping about midway on the diagram. The greatest motion is perhaps 6 millimeters.) Time 4.47 a. m. " It seemed to me the sharpest shock since 1868. It was followed by three slight tremors, and another at 6.20 p. m."—Prof. Soulé.

San Francisco: time 4.46.38.—Prof. Davidson. 4h. 46m. a. m. Shock in 3 distinct waves; the first lasting 5s., N. E. and S. W. for the middle wave, followed by light waves. Total duration 30 seconds. —T. T.

Carson City, Nevada.—The earthquake of July 31 was not felt here. The seismograph did not show a trace.—C. W. Friend.

Reports sent to the San Francisco papers follow, all dated July 31:

San José: there was a heavy shock at 4.45 this morning, the heaviest in seven years. No damage was done, and there was no excitement. The oscillations appeared to be north and south.

Oakland: the earthquake was quite severely felt in Oakland. The shock was very sharp, but little damage was done.

At the students' observatory at Berkeley the shock was registered as occurring at 4.47 o'clock in the morning and lasting fifteen seconds. The vibration was from north of west to south of east. It was followed by three slight ones at short intervals. Prof. Soulé says that this was the most severe earthquake that he has experienced since he came to California, in 1869.

Sacramento: there was no earthquake here.

Napa: an earthquake at 4.45 this morning, preceded by tremors which continued about six seconds. The shock which followed was quite heavy, lasting four seconds. The vibrations were north and south. No damage.

Petaluma: two heavy shocks at 4.45 o'clock a. m. The vibrations were from east to west.

Martinez: there was a severe shock at 4.50 o'clock this morning, lasting several seconds. No damage.

Gilroy: there was a slight shock at 5 o'clock this morning.

Santa Cruz: an earthquake was felt here at 4.50 o'clock this morning, lasting several seconds. The vibrations were west to east.

Centerville: two heavy shocks at 4.47 o'clock of about twenty-five seconds' duration. The vibrations were east and west. No damage has been reported as yet.

Los Gatos: a severe earthquake at 4.50 o'clock. The wave was east to west. Houses creaked, glass rattled, and many were awakened out of a sound sleep (VI). Considerable alarm was felt.

Santa Rosa: a sharp earthquake at 5 o'clock this morning, lasting about five seconds. The vibrations were southeast to northwest.

Benicia: three distinct shocks at 4.50 o'clock this morning. The first was quite strong and lasted several seconds, and was followed by two lighter ones. The vibrations seemed to be north and south.

Newark: a severe shock at 4.45 o'clock. The vibrations were from north to south and the duration was about ten seconds.

Concord: at 4.40 o'clock this morning a sharp shock, succeeded by a tremble that lasted fully two minutes. The direction of the shock was southeast to northwest; duration, thirty seconds. At about 3 a. m. a light shock was felt. In the night also another.

San Leandro: the heaviest shock since 1868 occurred at 4.46 o'clock this morning. A low rumbling sound preceded the first and heaviest shock, which lasted about one and a quarter minutes. The first half minute the oscillations were light and easy. Then for a quarter of a minute they were heavy, after which they gradually became less and less. Ten minutes after the first shock another slight shock was felt, and six minutes later another. The oscillations were from north to south. The damage includes one chimney thrown down and some crockery broken (VII).

1889. 6:19:39 p. m.

Oakland: slight shock (I) momentary.—F. G. Blinn.

1889. August 7; 3:43; 11 p. m.

Mount Hamilton: very slight shock suspected by E. S. H. (I?).

1889. August 13; 4:43 a. m.

Oakland: sufficient to awaken a few sleepers (III, IV?). Appears to have been very local in character, and confined to Alameda and Central and West Oakland, as it was not felt in San Francisco or East Oakland. "Slight."—Cal. S. W. Service *Review*.

1889. August 23; 2:32:46 p. m.

Mount Hamilton: very slight shock. Felt by some persons and not by others in the same room; time, 2.32.46.—E. S. H. Time, 2.32.48. —J. M. S. Ewing machine not started. Very small record on the duplex pendulum seismograph (I).

1889. August 27; 6.15 p. m.

Southern California: not felt at Mount Hamilton. The following are dispatches to the San Francisco papers:

Pomona: this evening at 6.15 the most severe shock that has been felt in this locality for fifteen years was observed. There were two distinct shocks, accompanied by a peculiar noise that sounded as though houses and buildings were falling. The shocks were about a second apart. Several people were thrown to the floor and nearly every one ran out of doors in a moment. Dishes were rattled from shelves, and in the stores goods were thrown down on the floor. Many windows were cracked and broken and buildings shook, but no damage was done to them. At the Pomona Progress office the type was pied, and at the Hotel Palomares glassware and crockery were broken (VII).

Los Angeles: a sharp shock occurred here at 6.13 this evening. It began with a light tremor, which lasted a few seconds. Then the vibrations grew stronger and ended with two heavy shakes. The entire duration of the disturbance was about ten seconds. Clocks stopped and ceilings cracked. Many people ran into the streets. So far as now known no damage was done, but the quake was the most severe experienced here in many years (VII).

Santa Ana: two very marked shocks occurred here this afternoon at 6.12. The vibrations were from southwest to northeast and followed each other in quick succession. Crockery rattled, chandeliers and swinging signs vibrated, and people in the second and third stories of buildings were considerably frightened in some cases. The quaking continued for seven seconds, but no damage whatever resulted (VII).

Santa Monica: there was an earthquake here at 6.16 p. m., lasting eight seconds. It was very noticeable in all buildings, but not strong enough to do any damage. The vibrations were from north to south. It was the first known here for many years.

Pasadena: a very perceptible shock at 6.20 p. m., lasting from five to six seconds. Dishes on the dinner-tables were shaken and some were broken (VII).

San Bernardino: "quite a distinct shock of earthquake was felt in this city last evening at about 6.15. The vibrations lasted several seconds and were from east to west."—San Bernardino *Times-Index*, August 28. A light shock (III). Time noted by George Jordan, jeweler, at 2.12.20 p. m. Clock one miunte fifteen seconds slow by Signal Office signals, hence Pacific standard time = 6.13.35. A slight rumbling noise before the shock is generally reported. The shock is described as a single impulse, lasting but one or two seconds, but reports disagree as to direction of the vibration.—W. C. Parmley.

1889. "In the autumn," 18h.

An earthquake at Puyallup, Washington. Intensity II. Several shocks.—P.

1889. September 24; 8 a. m.

Reported in S. F. papers:

Napa: there was a slight earthquake at 8 o'clock this morning.

Winters: there was a slight shock here this morning just before 9 o'clock. The direction of the shock was from west to east.

Woodland: quite a heavy earthquake at 8 o'clock this morning. There were two distinct vibrations and they were from north to south.

1889. September 29; 8:10 p. m.

Wawona: there were heavy shocks of earthquake at 8.10 Sunday night and at Yosemite followed by two lighter ones. The vibrations were east and west and lasting twenty-two seconds. Other light shocks were reported at Yosemite. A special dispatch from J. H. Lawrence, at the Big Tree Grove, says there was a severe shock of earthquake at 9.30 Sunday evening, continuing about twenty seconds. The vibration was distinctly east and west, accompanied by a rumbling noise resembling a heavy train of cars crossing a bridge, followed by two lighter shocks. Hollow logs and trees oscillated (VI or more severe).

1889. September 29.

Rancho Laguna de Tache, Kingsburg: a slight shock in section 29, T. 17 S., R. 21 E., at 9.20 p. m.—S. C. Lillis. (See preceding paragraph.)

1889. September 30; 12:17:30 p. m.

Kingsburg, same place as above. A slight shock.—S. C. Lillis.

1889. October 15; 4:30 a. m.

Carson: E. W., light.—C. W. F.

1889. October 20; 3 p. m.

Point No Point Lighthouse, Washington. Slight shock.

1889. October 24; 7:20 a. m.

East Oakland: tracing obtained with seismograph shows (magnified) vibrations of about 1.6 millimeters. The pen did not return to the starting point. Light shock (II) noticed by several persons. Time noted by Mr. Ireland at 7.19.45 (wrongly given in the Oakland papers as 7.15). Felt by one or two persons in Oakland and Alameda.—F. G. Blinn.

1889. November 14; 6:54 p. m.

San Lorenzo: the telegraph operator reports an earthquake at above time. East Oakland: the seismograph record shows a (magnified) motion of 1 millimeter. The shock was not felt here by anybody.—F. G. Blinn.

1889. November 15; 7:55 p. m.

East Oakland: a slight shock (II) felt by three persons in the vicinity. No record on seismograph, hence motion was probably vertical. The shock was felt in San Francisco, and noticed in the daily papers.—F. G. Blinn.

San Francisco, 7h. 55m. p. m. Light shock. Duration 2 seconds. —T. T.

Healdsburg: "a very severe shock of earthquake was felt in this city last night at 7.55. It was the heaviest experienced here in many years."—S. F. papers.

1889. December 2; 6:30 p. m.

East Oakland: the seismograph record (magnified) shows a number of nearly circular tracings about two millimeters in diameter, inclosing short irregular lines in different azimuths. The time was noted by a neighbor, as I was not at home when the shock occurred.—F. G. Blinn.

1889. December 14; 5:30 a. m.

Carson: E. W., light.—C. W. F.

Note by Dr. Keeler.—" The present bulletin is to be regarded as little more than a list of recorded earthquakes in California in 1889 and a collection of such data as are available for estimating the intensities of the different shocks. Accurate observations of earthquakes are difficult to obtain, as the instruments employed require some skill in the observer and a certain amount of attention to be always in working condition. The sensations experienced during an earthquake shock vary greatly for different persons, and descriptions based on the feelings alone are apt to be extremely unreliable. It is hoped, however, that other stations provided with suitable instruments can be established in different parts of the State, and that eventually sufficient data can be accumulated for a more complete study of earthquake phenomena on the Pacific coast than the material now available would permit." *These remarks apply to the whole of the present volume.*—E. S. H.

EARTHQUAKES ON THE PACIFIC COAST, 1890.

1890. January 15; Mount Hamilton; 5:05 ± 1m. a. m. (Prof. Holden).

Intensity = V.—Mr. Keeler noted the time by watch, P. S. T.[1] = 5.05.3 ± 10s. a. m. Intensity = IV. Time by earthquake clock = 5.02 a. m.

The record of the duplex seismograph shows the actual displacement of the pendulum bob to have been 2.6 mm., in a direction

[1] P. S. T.—Pacific slope time, which is Greenwich time *less* 8 hours.

almost exactly northwest and southeast. The record consists of a single nearly straight line.

San José: two shocks felt about 5 o'clock a. m., sufficiently heavy to awaken sleepers; from north to south.

1890. January 18; Napa.

Two slight shocks. Vibrations from north to south.

1890. Santa Barbara; 3:30 p. m.

Reported in the *Chronicle* as "quite a heavy shock."

1890. January 23; Chabot Observatory; 4:18 $\pm$ 1m. a. m.

Time observed by George B. Fox. The seismographic record indicates the total actual displacement of the pendulum to have been 2.8 mm., in a direction from "north by east" to "south by west." The tracing is made up of five small waves (small with reference to the total length of the tracing), which look as if they might have resulted from a simple harmonic motion having displacements in an east and west direction.

1890. January 23; 4 a. m.

Berkeley: slight shock.

1890. February 1; 5:15 p. m.

Admiralty Head Lighthouse, Washington: light shock.

1890. Santa Ana, January 24.

The San José *Mercury* reports:

A very distinct shock, lasting 4 seconds, was felt this afternoon at 1.15; and at 4.30 o'clock there was a larger and more pronounced shock, lasting ten seconds. The direction was northeast and southwest.

1890. February 5; San Diego; 10:15 p. m.

"Distinct shock; vibrations from east to west."

1890. Santa Ana; 10:14 p. m.

"Shock lasted eight seconds. Vibrations from northeast to southwest."

1890. February 5; San Bernardino.

"Three distinct shocks, preceded by a low rumbling noise. The shock (?) lasted for four or five seconds."

The three reports above are all from newspapers.

1890. February 9; San Bernardino; 4h. 6m. a. m.

Following is the report published in the *Times-Index* of San Bernardino of February 10:

"Quite a heavy shock yesterday morning at 6 minutes past 4 o'clock. The vibrations were north and south."

The *Examiner* of S. F. reports the following:

1890. San Pedro, February 9; 4h. 7m. a. m.

Three mild but distinct shocks. The vibrations lasted for several seconds and were from east to west.

1890. Colton, February 9.

A heavy shock at 4 o'clock this morning.

1890. Pomona, February 9.

At 4 o'clock this morning three distinct shocks were felt here. Nearly every one was roused from his slumbers, but little damage was done. In the *Progress* office type was "pied," and some panes of glass were broken about the city (VI).

1890. San Diego, February 9.

An earthquake was felt at 4 o'clock this morning. It lasted about a minute, and was accompanied by rumbling noises.

1890. Tehachapi, February 13; 2:10 a. m.

The following is from the San Bernardino *Times-Index:*

Three light but distinct shocks. They occurred at intervals of about twenty minutes. The second shock lasted several seconds.

1890. February 15; Los Angeles; about 4 a. m.

Reported as follows in the Los Angeles *Herald* of February 16: "Residents in this city and dwellers in its suburbs generally were very rudely awakened from their slumbers yesterday morning at about 4 o'clock (VI). A long, low rumbling noise as of distant thunder along the crests of the mountains was heard by people who were awake at that hour, and this was soon followed by a very decided shock. Houses shook, windows rattled, pictures vibrated on their hooks, and it was only very sound sleepers who were not roused. The oscillations were of a long, steady character rather than of the short, jerky order often felt in earthquake movements. The vibrations were nearly from northeast to southwest, and were separated into three distinct divisions. The first was the heaviest, followed by another lighter one at a short interval, and then, after a pause, a third little kick, less pronounced than the others. This is the second shock in this section within a year. In old days it was noted for its frequent seismic manifestations, but for forty years they have not been pronounced. Their center is near the San Jacinto peak."

Gilroy, midnight: a light shock.

1890. March 8;

Olympia, Washington, III.—P.

1890. March 15; 20h.
Roslyn, Washington, III.—P.

1890. March 29; 14h. 30m.
Roslyn, Washington, III.—P.

1890. April 11; Ukiah; 11:30 a. m. (?).
Vibrations from southeast to northwest.

1890. April 15; Mount Hamilton; 2:00 a. m.
No record except the tracing of the duplex seismograph, which is an almost perfectly straight line running northwest and southeast. The total actual displacement of the pendulum bob is 1.9 mm.

1890. April 24; Mount Hamilton; 3:36 a. m.
The duplex seismograph gives an exceedingly complicated tracing in the general direction northwest and southeast. The maximum possible displacement of the pendulum bob was 4.0 mm. in the direction indicated above.

At right angles to this the maximum displacement was 1.4 mm. The tracing is folded on itself from nine to eleven times.

1890. Mills College; about 3:39 a. m.
The tracing from the duplex seismograph indicates motion in every possible azimuth. There is no marked tendency in any one direction. The maximum excursion of the pendulum bob is 11.1 mm. running from north-northeast to south-southwest. By maximum excursion is here meant the maximum diameter of the diagram.

1890. Berkeley; 3:38 a. m. (Prof. Soulé).
The tracing from duplex seismograph gives maximum displacement (6.4 mm.) in a direction east-northeast and west-southwest. There is quite a well-marked displacement of 4.3 mm. in an azimuth which may be defined as "west-northwest" to "east-southeast." The tracing recrosses itself from fifteen to twenty times. The disturbance at Berkeley seems to have been considerably smaller than at Mills College.

1890. Chabot Observatory; 3:37:44 a. m.
Duration six seconds; preceded by a rumble lasting ten to fifteen seconds. General character and size of tracing from duplex seismograph about the same as that observed at Berkeley. Maximum double amplitude of pendulum bob nearly east and west, amounting to 5.7 mm. (Mr. Burckhalter.)

1890. East Oakland; 3:37:40 a. m.
Mr. F. G. Blinn reports the duration at ten seconds and the intensity as (IV). The seismograph tracing is exceedingly complicated, recrossing itself probably fifty times. The maximum displacement is east and west.

1890. San Francisco; 3h. 40m. a. m.

Sharp shock. Duration 16 seconds.—T. T. Following is the report of Prof. Davidson, as given by the *Examiner*: "(1) First shock light, but awakened observer at 3.36.18.—P. S. T. Direction, east and west. (2) Continuous shock 3.37.03 to 3.37.23; first part slight; last 'shock like a terrier-dog worrying a rat.' Trace east and west and north and south, giving resultant northeast and southwest or northwest and southeast, according to circumstances. Shock rang door-bell in Prof. Davidson's room. Stopped clock in room 39, Appraisers' Building. Recorded by Frank Edmonds as northwest and southeast" (VI).

The following from the *Evening Bulletin* gives observations in other parts of the State:

1890. Salinas, April 24.

The heaviest temblor ever known here occurred at 3.40 this morning. Two light shocks were followed by a third and heavier, which lasted about twelve seconds. These were followed by four or five more, one of which was sharp and abrupt. The vibration was from east to west. Clocks were stopped, but no damage was done (VI).

1890. Benicia, April 24.

The people were awakened from slumber this morning at 3.45 by a very distinct shock. The vibrations lasted some seconds and seemed to be from east to west (VI).

1890. Los Gatos, April 24.

Two distinct and severe shocks were felt this morning about 3.40, the last shock being much heavier than the first, and of longer duration. The vibrations were from east to west. No damage was done, but many persons were considerably frightened and a few clocks were stopped (VI). A slight shock was also felt about 5.30, but it was scarcely noticeable.

1890. Brentwood, April 24.

A slight shock at 3.30 this morning.

1890. Gilroy, April 24.

The damage by the earthquake this morning was not great. The gas mains were disjointed and the lights extinguished (VII?).

1890. San Jose, April 24.

The shock this morning was very sharp, but no damage is reported. Many people were frightened out of their beds (VI?).

1890. Hollister, April 24.

Temblors began here at 3.32 a. m., lasting until 5.30 a. m. Thirteen distinct shocks were felt, and during the entire two hours a con-

tinuous vacillating motion was observable. The shocks were not sharp, but long continued and heavy rolling, the worst that have ever been experienced here. Only nominal damage was done. A private despatch states that the McMahan House was twisted so badly that cracks were opened in it sufficiently large to admit a man's hand and that other damage was done (VII?)

1890. Redwood City, April 24.

Three shocks of earthquake occurred this morning, ending with a severe jar, which threw crockery and other articles from the shelves of several residences. Clocks were stopped at 3.37, the hour of the occurrence. The vibrations were east and west and the duration twenty seconds. The residents assert these were the severest shocks since 1868 (VI?, VII?).

1890. Point Reyes, April 24.

A sharp shock of earthquake occurred here very early this morning.

1890. Centerville, April 24.

A heavy earthquake shock was felt here at 3.40 this morning. It was preceded by two light shocks. Many were frightened, but no damage has been reported.

1890. Watsonville, April 24.

There were twelve distinct shocks of earthquake felt here after 3.30 this morning, the first and second being the most severe. The vibrations were from west to east. In the country north of town nearly all the chimneys were thrown down (VIII). The railway bridge across the Pajaro was misplaced and the train delayed.

1890. Napa, April 24.

At 3.40 o'clock this morning a heavy shock of earthquake was experienced here. The vibrations were north and south.

1890. Santa Cruz, April 24.

There was a heavy earthquake shock this morning at 3.48, but very little damage.

1890. Mayfield, Cal., April 24.

A slight shock of earthquake was felt here and in neighboring towns this morning. The vibrations were from northeast to southwest, and lasted eight seconds. There was a heavy atmosphere, with no wind. The tops of trees rocked, making a noise like a heavy wind blowing. Plastering was broken and the depot clock and others stopped at 3.37 o'clock (VI). The temperature was 48°. Superintendent Bassett went south by a special train to look after the damage done to the track by the shake between Pajaro and Sargents. It is reported that the track was moved a foot out of line, and that the ground settled six

inches in places. The bridge, fifty feet high, is impassable at both ends, the rails being pulled a foot apart. A large force of men is at work, and they expect to have the track so that trains can pass in a few hours. At Sargents and Gilroy there were more than a dozen shakes, and chimneys were knocked down. (VIII?). (See Gilroy preceding).

1890. Carson City, Nevada.

No time reported. The duplex seismograph indicates a disturbance about one-quarter as large as that at Berkeley. (C. W. Friend.)

1892. San José, April 24; 3:37:43 a. m.

Seismograph at the University of the Pacific furnishes a diagram having a maximum double amplitude of 16.2 mm. From the manner in which the index has run all over the glass one would think the equilibrium of the pendulum too nearly neutral.

1890. May 11; East Oakland; 1:00:15 p. m. (Mr. Ireland); 1:00:18 p. m. (Mr. Boise).

Mr. Blinn's seismograph makes the disturbance almost entirely in an east and west direction; its amount (maximum double amplitude) was 1.0 mm. The diagram which Prof. Keep sends from Mills College indicates a slightly smaller disturbance in a direction southwest and northeast.

1890. May 11; San Francisco; 1:00:15 p. m. (Mr. William Ireland).

Intensity = IV, Rossi-Forel scale. S. F.: 1h. 1m. p. m. Light shock, duration 2 sec.—T. T.

Following is a newspaper account of the shock as felt at San Leandro, May 11: "A very heavy shock of earthquake was felt at this place at 1.03 o'clock this afternoon. The oscillations were north and south and the duration 5 or 6 seconds. No damage reported, although many of the older houses in town were loosened up considerably, notably the depot of the Southern Pacific Company."

1890. May 14; Santa Cruz.

The following general account is taken from the newspaper of even date:

Ever since the big earthquake of the 24th of April there have been daily seismic disturbances along the line between Pajaro and San Juan, where the earthquake was heaviest. Each day three or four small shocks occur, and yesterday six quite pronounced ones were felt. Two were felt at 5 o'clock this morning in this city. The fissure made on the Chittenden ranch, above Pajaro, during the big earthquake has been gradually increasing in depth and width. The railroad company is keeping a force of carpenters in the vicinity of the bridges between Pajaro and Gilroy for fear of damage by the shocks if they get heavier.

1890. June 1; Healdsburg; 1:21 p. m.
Slight shock.

1890. June 12; 4 a. m.
Berkeley: slight shock N. W. to S. E.—Professor Soulé.

1890. June 29; Santa Rosa; 7:25 a. m.
"Three distinct shocks; people awakened; vibrations from north to south" (VI).

1890. Petaluma, June 30.
An earthquake about 6 o'clock a. m. The vibrations were from east to west.

1890. Santa Rosa, June 30.
Three earthquake shocks were felt here about 11 o'clock (a. m.?). They were not quite as severe as those in the morning.

1890. Santa Cruz, June 30.
Earthquake shocks in this city at 12.30 this afternoon shook all the houses in town. The first was slight and was followed in a second by a much heavier shake. No damage. The vibrations were east and west. A telegram from Sargent station, near the center of the seismic disturbance of last April, states that the shock was quite severe there, breaking crockery in the houses. (VI).

1890. June 30.
Berkeley: slight record on duplex instrument.—Professor Soulé.

1890. July 1.
San Francisco: "At 33 minutes past midnight of Monday there was a sharp shock of earthquake felt in this city, lasting ten seconds. The direction of the vibrations was principally northwest and southeast, with a shock nearly north and south. It was felt in nearly all portions of the city and had the effect of rousing many people from their slumbers. Gas fixtures and windows were set rattling, and in some houses picture frames, loosely fastened on the walls, were thrown to the floors. It was not noticeable by people walking on the streets, and had no distinct violence in the down-town hotels" (VI).

1890. July 1; Gilroy: 12:35 a. m. (newspaper).
"Sharp shock from north to south lasting about one minute."

1890. July 4; Eureka; 4:30 p. m. (newspaper).
"Quite a sharp shock."

1890. July 24; Bakersfield; 3 a. m. (newspaper).
"Severe shock."

1890. July 26.

The *Examiner* contains the following:

Sissons: There were three earthquake shocks this morning at 1.45 o'clock. The vibrations were north and south.

1890. Hydesville, July 26.

Several severe shocks of an earthquake were felt at this place at 1.40 a. m. to-day, lasting about twenty seconds, and another slight shock at 8 o'clock.

1890. July 28; Petaluma; 12:03:35 a. m.

Two slight shocks from north to south.

1890. August 17; Mills College; 6:50 a. m. (Prof. Keep).

Slight, but distinct shock. The tracing of the seismograph shows three vibrations (averaging 0.3 mm.), in a direction from one point south of east to one point north of west.

1890. August 23; Mono Lake.

The following is from the Homer *Index:*

"Remarkable earthquake at Mono.—The southern end of Mono Lake was considerably agitated last Sunday, and dwellers in that shaky locality were much perturbed. Steam was issuing from the lake as far as could be seen, in sudden puffs, and the water was boiling fiercely, while high waves rolled upon the beach and receding left the sand smoking. In a moment the air was thick with blinding hot sulphurous vapor, and subterraneous moans and rumblings made the witness think that the devil was holding high carnival down below. The fences wabbled up and down and sideways.

"This appalling fracas lasted about two minutes. Then came a blessed quiet for a moment, followed by a sudden twitch of the earth, as a horse jerks his hide and dislodges a bothersome fly. The shock threw men and animals off their feet with bruising violence.

"It was some hours before the lake ceased to emit columns of steam and the water became very hot. Two springs near the house, long noted for the coldness and purity of their water, changed their character and spouted hot mud for two days, when they flowed cold water again. A stack of 200 tons of hay was moved 70 feet south without disarranging it" (IX?).

1890. September 3; Mount Hamilton; 2:21:20 p. m. (accurate to one or two seconds), P. S. T.

Felt by Prof. Holden in third story of brick house and estimated by him as II on Rossi-Forel scale. Recorded on duplex seismometer, but did not start the larger one.

A slight shock was also felt at San Francisco at 2.30 p. m.; likewise at Gilroy.

1890. September 4; Mount Hamilton; 10:06:45 a. m. (E. C. Holden).
"Swung the hanging lamp in my study."—E. S. Holden.

1890. September 5; Merced; 2:15 p. m.
Vibration east and west.

1890. Calico, September 19.
A severe shock of earthquake occurred at 12.15 last night. There were vibrations east and west. There was another shock fifteen minutes later.

1890. Daggett, September 19.
Two earthquakes were felt here at 12.25 and 12.50 this morning. The vibrations were east and west. No damage was done.

1890. San Bernardino, September 19.
A light earthquake shock visited this city a little after 12 o'clock this morning.

1890. Barstow, California, September 19.
There was an earthquake at 12.15 this morning, with a rumbling sound. No damage.

1890. October 3; Healdsburg; 12:05 p. m.
"Sharp shock, accompanied by long and distinct rumbling. Vibrations north and south."

1890. October 8; 2 p. m.
Point No Point Lighthouse, Washington, slight shock.

1890. October 29; Mount Hamilton.
Two distinct shocks.

First—8.36.29 a. m. ± 2s., P. S. T. Rossi-Forel, IV to V.

Second—8.39.29 a. m. ± 2s., P. S. T. Rossi-Forel, III. (Prof. Holden.)

Prof. Barnard reports as follows: "Coming to the observatory, half-way up the plank walk heard two distinct and heavy jars in the frame cottages as if they were falling down. These followed each other by about one or two seconds. *Did not feel any shock.* The noise of the shaking of the frame houses could have been heard perhaps an eighth of a mile. Reaching the observatory, another shock occurred; did not feel it; heard a rattling. This was at 8.39.35 ± one or two seconds, P. S. T.

1890. December 4; Lone Pine; 9 o'clock p. m.
Ten distinct shocks felt from 9 to 11. No damage done.

"This is the first disturbance at Lone Pine for eight or ten years."—C. Mulholland.

EARTHQUAKES ON THE PACIFIC COAST, 1891.

1891. January 2.

Generally felt throughout the State.

1891. Lick Observatory (Mount Hamilton), January 2; 12h. 0m. 18s.

A *violent* earthquake shock stopped our standard clock at eighteen seconds after noon to-day. The pendulum swings about north and south.

Several ceilings were cracked in the observatory, and large pieces of plaster were thrown down in the brick houses. No damage was done to the instruments. The earthquake registers indicate by far the severest shock since 1868 in northern California. Its intensity was VII on the Rossi-Forel scale. The pen of the duplex seismometer was thrown completely off the glass plate. Some definite idea of the force may be had when I say that a swinging lamp, making a pendulum of about 15 inches in length, which is suspended in my study, was still in vibration twenty minutes after the shock.

Framed photographs on my mantel were overthrown. The large telescope is secured to its base by four holding-down bolts, and it is as safe as it can be made. (Professor Holden.)

San Francisco was visited by two distinct shocks of earthquake at noon yesterday (Jan. 2).

Prof. Davidson states that his chronograph recorded the time of the shock to be 12.00.40,[1] with an entire duration of fifty seconds. A comparison of directions observed by various persons indicates the wave to have moved from southeast to northwest. Long, rolling shock, duration 33 sec.—T. T.

1891. Santa Cruz, January 2.

There was a heavy earthquake here at 12.02 this afternoon. The shock, which passed from southwest to northeast, lasted ten seconds, and was the heaviest felt here in years. Only very slight damage was done, but the people were greatly frightened (VII).

1891. Salinas, January 2.

A very severe shock at 12 o'clock noon to-day. The vibrations were from north to south.

1891. El Verano, January 2.

A severe shock at 12.20 o'clock. It moved from southeast to northwest. Houses were shaken up.

1891. Los Gatos, January 2.

A sharp shock was preceded by a rumbling sound at 12.01 o'clock this afternoon. The duration of the shock was fifteen seconds.

[1] 22s. later than at Mount Hamilton.

No damage.—Berkeley: duration 3 sec. N. W. and S. E.—Professor Soulé.

1891. Gilroy, January 2.

One of the heaviest earthquakes ever felt here occurred at 12.01 this afternoon. The duration was less than half a minute, but it was accompanied by heavy rumblings and a sickening, swaying sensation. Gas fixtures and movables swayed and clattered considerably (VII?).

1891. Stockton, January 2.

Rather a sharp shock precisely at 12 noon. The vibrations were south to north.

1891. Lathrop, January 2.

There was a severe shock at 12 o'clock. Houses squeaked, clocks stopped, lamp chimneys were broken, etc. No further damage was done. Apparently the direction of the shock was from east to west (VI).

1891. Modesto, January 2.

A sharp shock was felt here at noon to-day. The shock lasted fifteen seconds. The vibrations were north and south.

1891. San José, January 2.

At 12 o'clock a sharp shock was felt here, the movement being north and south, and it lasted about fifteen seconds. Clocks were stopped and buildings rocked, but no damage was reported (VI?, VII?).

1891. San José, January 2.

"Buildings were shaken so that their motion was plainly visible. Many clocks stopped at 10.00.30 p. m." [1]—*San José Herald.*

1891. Petaluma, January 2.

This afternoon, a few minutes past 12, a sharp shock, with vibrations from east to west.

1891. San Leandro, January 2.

A sharp shock was felt here to-day at 12.02. The oscillations were from northeast to southwest. The duration was about ten seconds.

1891. San Rafael, January 2.

A rather sharp shock was felt here at 12 noon to-day, lasting several seconds. The vibrations were from east to west.

[1] 12s. later than that at Mount Hamilton.

1891. Boulder Creek, January 2.

A severe shock was felt here at 12 o'clock, continuing for several seconds. The vibration was from southwest to northeast. There was a general rush for the streets, but no damage was done (VII).

1891. Spanishtown, January 2.

A severe shock occurred at three minutes before noon to-day. The vibrations were from east to west.

1891. Merced, January 2.

A slight shock was felt here at 12 o'clock to-day with vibrations from east to west. The shake was heavy enough to cause the glassware on the shelves to rattle (VI?).

1891. Redwood City, January 2.

Two sharp shocks were felt here to-day at two minutes past noon. The vibrations were east and west.—*S. F. Examiner.*

Seismographic records obtained at Mills College by Prof. Keep and at Oakland by Mr. Blinn show the greatest disturbance to be in a direction running from northeast to southwest.

Mr. Blinn's seismometer gives a diagram indicating that the maximum double amplitude of the pendulum was 3.8 mm. The diagram consists of many (not less than 25) intersecting loops. So far as one may judge from the tracing, the instrument was in good adjustment.

Prof. Keep's tracing is of the same general character, but with a maximum double amplitude of 5.8 mm.

The Carson City seismometer (C. W. Friend) gives a tracing even more complicated than either of the preceding; it is the smallest of the three, but every azimuth is filled with fine lines. The glass plate of the San José instrument was jarred by the earthquake and the record spoiled.

A third shock of intensity (III) on Rossi-Forel scale is reported by Prof. Holden as occurring at the Lick Observatory at 8.18.21 p. m.

1891. January 12; Berkeley; 1:36 a. m.

Prof. Hilgard reports a "light earth-tremor lasting a little less than a second, but preceded by a marked rumbling from the southwest." (Qu.?, a. m.?)

1891. January 13; Mount Hamilton; 2:58 p. m.

I to II Rossi-Forel scale; observed by Mrs. Breseno.

1891. February 15; Downieville.

Quite a shock felt between 2 and 3 a. m.

1891. January 21; San Francisco; 2:24:35⅛ p. m.

Artificial earthquake, caused by the explosion of 3,000 pounds of blasting powder for the purpose of clearing away a hill in San

Francisco. But few rocks were scattered; the hill collapsed and the earth in the neighborhood showed deep crevices. No disturbance was observed on the San José seismograph, which was watched by Prof. George. Nor was any record obtained at Mount Hamilton, where it was looked for with mercury basins.[1]

1891. February 24; Independence; 3:10 a. m.

Reported by Mr. C. Mulholland as follows: "A strong earthquake shock. The tremor was preceded an instant by a rumbling sound. The motion appeared to be a little east of south to west of north. The house shook so that the pans and dishes rattled. A strong breeze from the south had been blowing all night, but at the time of the tremor there was a brief but complete lull; then the breeze set in as before."

1891. March 7; 7:35 p. m.

Admiralty Head L. H., Washington. A light shock.

1891. March 7; 7:30 p. m.

Smith Island L. H., Washington. A slight shock.—Ms. U. S. L. H. Board.

1891. April 4; Mount Hamilton; 4:30 a. m.

"A light, but prolonged shock from east to west," reported by Prof. Holden.

1891. April 12; Mount Hamilton; 9:29(?)41.

"A sudden, slight earthquake of intensity II, Rossi-Forel scale," reported by Prof. Holden.

1891. April 13; Healdsburg.

A sharp shock at 11.40 p. m.

Visalia: earthquake at 10.30 p. m. Vibrations from north to south.

1891. San Francisco, May 6; 8h. 30m. p. m.

Light shock, duration 4 sec.—T. T.

1891. Berkeley, May 8; 6:10 p. m.

Prof. Soulé writes: "Very slight in San Francisco and Oakland, so much so that comparatively few people noticed it. The Ewing and Gray-Milne instruments, though in excellent order and very sensitive, were not set off. The duplex gave a small record indicating that the direction of the shock was from northwest to southeast. I should rate it as II in the Rossi-Forel scale."

1891. San Rafael, May 8; 6:08 p. m.

A heavy shock lasting about six seconds. The vibrations were from west to east.

[1] *Publications Astronomical Society of the Pacific*, vol. III, page 132.

1891. May 19; Susanville.

Seven shocks felt; two very heavy; time not reported.

1891. May 20; San Francisco; 10h. 4m. p. m.

Light vibration, duration 2s.—T. T. Mills College: Prof. Keep writes: "An earthquake was felt here last night about 10 o'clock. The shock was slight, but was preceded by a peculiar sound which made me brace myself for a severe shock." The seismographic record accompanying this letter shows the greatest disturbance to have been in a north and south direction.

1891. June 22; Pasadena and San Fernando.

Slight shocks felt between 8 and 9 o'clock in the evening.

1891. June 28; San Francisco; 3:02:45 a. m.

Reported in S. F. *Chronicle* as follows: "A double shock of earthquake occurred early yesterday morning. It was not heavy, and was of such brief duration that not many of the citizens who were awake at the time could have noted it. F. W. Edmonds, the assistant in Prof. Davidson's observatory, was at work when the shock came and noted its features, afterwards comparing his figures with those recorded by a small seismograph. The first shock began at 3.02.45, Pacific standard time, and ended five seconds later. The vibrations were east and west. Then at 3.03.05 there was another shock, so brief that the duration was not recorded. It was sharper than the first shake, but had the same motion.

Prof. Davidson remarked that one night last week, while he was making observations for latitude, there was an almost imperceptible quake. He was reading the level of the instrument at the time and noticed that it was suddenly shaken, the bubble moving backward and forward several times in quick succession. The extremes of this motion as marked by the bubble were three or four millimeters apart. The vibrations were north and south."

Mount Hamilton: waked sleepers, set hanging lamps in vibration, rattled windows, pictures, stoves, etc. Ewing seismograph clock did not start; components were therefore recorded as straight lines. The actual displacements of the earth [magnified] were as follows: North and south = 0.24 inches; east and west = 0.39 inches; vertical = 0.15 inches.

Mr. Campbell makes the time 3.02.36 ± 2s.—P. S. T.

Mr. Schaeberle makes the time 3.02.35 (watch).—P. S. T.

Intensity on Rossi-Forel scale, V.

1891. Santa Cruz; June 28; about 3 a. m.

Shock not felt at the lighthouse, two miles from town. (Ms. kindly communicated by U. S. Geological Survey.)

Mayfield: "a slight shock of earthquake was felt here at 3 o'clock this morning. It lasted four seconds. Trembling vibrations were followed by two shocks."—*S. F. Chronicle.*

1891. June 29; Mount Hamilton; 8:06:31 ± 2 a. m. (W. W. Campbell); 8:06:32 (J. M. Schaeberle).

One quick shock lasting for less than half a second; Rossi-Forel I or II. "Recorded on duplex, but not on Ewing seismometer."

1891. July 12; Berkeley.

Slight record on duplex instrument.—Professor Soulé.

1891. July 13; Monterey; 4:27 p. m.

A sharp shock with vibrations from southwest to northeast. Clocks were stopped and crockery thrown from the shelves (VI).

1891. July 13; Santa Cruz Lighthouse; 4:26½ p. m.

Duration about two seconds. (Ms. of U. S. Geological Survey.)

1891. July 17; Hollister; 1 a. m.

Quite a severe shock; no damage.

1891. July 30.

Lerdo, Mex., was the center of a very severe earthquake about 6 o'clock a. m. It appears to have caused a tidal wave of considerable height at the head of the Gulf of California. The country is so thinly and poorly settled that no damage was done. The reports of this earthquake are so indefinite and contradictory that we have little reliable information regarding what must have been at least a very widespread disturbance.

1891. August 9; Monterey; 9:41 a. m.

A heavy shock, causing buildings to rock. The vibration was from north to south.

1891. August 9; 9:42 a. m.

Santa Cruz Lighthouse: duration 2 seconds. (Ms. of U. S. Geological Survey.)

1891. August 11; Humboldt Lighthouse.

Three shocks in rapid succession, (1) at 3h. 18m. 30s. a. m., (2) at 3h. 18m. 20s., (3) at 3h. 18m. 5s. (*sic*). N. B.—All the times at this station are from a clock which is regulated by the (calculated) times of sunrise and sunset. (Ms. kindly communicated by the U. S. Geological Survey.)

1891. September?

Tacoma, Washington, II, several shocks.—P.

1891. September 10; Berkeley.

Very distinct record, E. S. E. and W. N. W.—Professor Soulé.

1891. September 12; Cedar City, Utah; 8:48 p. m. (C. Mulholland).

"Shock heavy and accompanied by a sound like that of a heavily loaded wagon passing over a street paved with granite blocks. Its duration was brief, and there was but one shock."

1891. September 16; Salem, Oregon; 8:30 p. m.

The shock was brief and distinct, and was followed by a wave-like motion lasting several seconds. It was felt in all large buildings; windows rattled.

1891. September 21; Port Angeles, Wash.

Reports differ as to time, some claiming that the shock occurred at 4.10 a. m., others at 5 a. m. It is possible there were two distinct shocks. The direction of vibration was from northwest to southeast. Many people were awakened from sleep. Houses trembled and chinaware rattled (VI).

Port Townsend: shock felt shortly after 4 o'clock a. m. Dishes rattled and sleeping people were awakened (VI).

1891. September 22; Victoria, B. C.; 3:40 a. m.

Sharp shock felt all over city; lasted about seven seconds.

1891. September 23; Healdsburg; 1:30 p. m.

"Very severe and long-continued shock; one of the most severe ever felt in this vicinity."

1891. October 2; Mount Hamilton.

Prof. Barnard reports "from one and one-half to two seconds' duration. A very decided shock. Gradually increased in intensity. 7.19.55 P. S. T. end of shock." Prof. Holden gives the time as 7.19.55. Intensity II on Rossi-Forel scale. No record on seismometers.

1891. October 11.

Felt generally over the central portion of the State. Following are newspaper accounts:

San Francisco: a slight earthquake shock was felt throughout the city last night. It seemed like the heavy, noisy rumble of a cart, and was perceptibly felt in every part of the town. Prof. Davidson was at work in his observatory when it occurred. The pier upon which his instrument is placed was not thrown out of level in the slightest degree. The earthquake lasted for thirteen seconds, beginning at twenty-seven minutes and thirty-two seconds after ten o'clock and ending at twenty-seven minutes and forty-five seconds after 10 o'clock. An unusual feature of the shock was that it began light and gradually increased until it was greatest during the last three seconds. The direction was southeast to east-southeast.

1891. San Francisco, October 11; 10h. 28m. p. m.

Heavy shock, S. E. and N. W., duration 20s.—T. T.

1891. Suisun, October 11.

At 10.29 o'clock to-night a heavy shock of earthquake shook up this quiet little city in a frightful manner. The shock lasted nearly half a minute. It was the heaviest earthquake known of here for years. The damage is slight, but the fright of the people was extreme (VII).

1891. Oakland, October 11.

A sharp shock at 10.26, the vibrations being from north to south. Windows were shaken, but no damage done.

1891. Oakland, October 11.

Oakland: Mr. Burckhalter reports from the Chabot Observatory that the mean time clock was stopped at 10.27.49 p. m. His seismograph shows the actual displacement of the earth to have been 2.5 mm. in an east and west direction (VI).

1891. Sacramento, October 11.

A pretty lively shock of earthquake, or a double shock, was felt here at 10.28, but it was not heavy enough to do any damage. Many persons did not feel it.

1891. San José, October 11.

A slight shock of earthquake was felt here at 10.28 this evening. The movement was from northeast to southwest.

1891. Berkeley; 10:25 p. m.

Slight at first; gradually increased; preceded by a rumbling noise. —Professor Soulé.

1891. Winters, October 11.

There was a heavy shock here about 10.30 o'clock. It was heavy enough to wake people from a sound sleep. The vibrations were from east to west and lasted two or three seconds (VI).

1891. Fairfield, October 11.

There was a heavy shock at 10.30 p. m. and another at 4 a. m., but no serious damage was done.

1891. Spanishtown, October 11.

Quite a heavy shock was felt here at 9.29.

1891. Sonoma, October 11.

Sonoma and vicinity were visited at 10.28 o'clock by the severest earthquake ever felt in this section of the State. The people were shaken out of their beds, chimneys were demolished, windows broken, and the interior of almost every plastered house

in the town shows effects of the shock, which lasted about eight seconds. The temblor was a series of vicious twisters. Pickett's residence and wine cellar at the outskirts of the town were badly damaged, the interior of the house presenting a scene of desolation. On S. F. Ringstrom's farm a large chimney fell. Several chimneys in town were also overthrown, but fortunately no one has been injured. Reports from all over the valley show more or less damage. On the Polpula ranch, which contains a number of warm-water springs, the earthquake caused the water to gush forth in perfect torrents. The first shock of the evening was slight and felt at 9.15. Then came the heavy one, after which, at intervals of an hour or so, there were eight or ten other shocks. More or less damage was done to every building in Sonoma Valley (VIII).

1891. Petaluma, October 11.

At twenty-five minutes past 10 the heaviest earthquake shock since 1868 passed through Petaluma. Door-bells were rung and some plastering badly cracked. The heavy shock was preceded a few minutes by a light one, and after it came six or seven other shocks, the last one being at 5 o'clock this morning. Many people were kept awake most of the night. The main shock lasted fully nine seconds (VII).

1891. Napa, October 11.

The heaviest shock ever felt here was experienced at 10.34 o'clock. The people rushed out into the streets greatly frightened, and the whole town was in commotion. The shock was especially heavy at the insane asylum, and the inmates were almost uncontrollable.

The first shock came at 9.16, but it was light. At 10.29 came the heavy shock, which lasted forty-six seconds. It was a twisting motion from right to left. Some people fainted, and all were greatly exercised, but no fatalities are reported. Lighter shocks followed during the entire night. Some say there were twelve shakes, while others profess to have counted as high as seventeen. Some people remained in the street all night, and others did not sleep for fear of a repetition of the dread sensation. The damage will not be very heavy on any one building, but in the aggregate is considerable. Scores of chimneys are thrown down or turned three-fourths around. Many brick buildings are badly cracked, and the wall decorations in most of the fine houses are badly damaged, while nearly every house had some bric-a-brac and crockery destroyed. The insane asylum reports some damage to the walls and tower, but nothing serious (VIII).

1891. St. Helena, October 11.

The heaviest earthquake shock ever experienced here occurred at 10.30 o'clock. Houses shook, crockery rattled, and clocks stopped.

The vibrations appeared to be south to north, followed half an hour later by a light shock, and one also at 5 o'clock this morning (VI?, VII?).

1891. Santa Rosa, October 11.

The severest earthquake felt here in four years occurred at 10.32 o'clock. The oscillations lasted forty-five seconds. A slight trembling was perceptible for three or four minutes.

1891. San Rafael, October 11.

The most severe earthquake experienced here for years was felt at 10.26 o'clock. The shock lasted about twelve seconds. It was preceded by a dull rumbling noise like a heavy wagon rolling over the pavement. Two shocks of lesser power were felt this morning about 4 o'clock.

1891. October 13; Mount Hamilton; 11:0:30 p. m. (Prof. Holden).

Intensity II, Rossi-Forel scale.

Prof. Barnard reports as follows: "Three shocks of earthquake were felt in rapid succession. Interval between the individual shocks about one and a half seconds. The last of these three was the most severe. This occurred at 11.00.09 P. S. T. The shocks were simply quick jerks, and ought to have been powerful enough to wake a person from ordinary sleep."

1891. October 13; Mills College; 10:28 p. m.

Prof. Keep sends a very complicated diagram from his seismograph, indicating disturbances in all directions. Maximum north and south = 3.0 mm.; maximum east and west = 4.0 mm.

The above figures are for the actual displacements of the earth.

1891. October 14; San Francisco; 4:33:23 a. m.

Felt in all parts of the city. Prof. Davidson says: "The last shake was similar to the one of the 11th instant in its wave-like vibrations. Its greatest force was during the first seven seconds, and its entire duration was ten seconds. Time of beginning, 4.33.23 o'clock a. m. Direction of the vibration, north and south."

Following are newspaper accounts:

1891. Napa, October 14.

The earth continues to tremble. Four shocks have been felt here this morning. At 4.30 a. m. the people were startled with quite a heavy shock, and several lighter ones have followed. The damage done by Sunday night's shock is much more than was at first supposed and will amount to several thousand dollars. Many of the people here are so terrorized that they have hardly slept since Sunday evening, and the slightest shock now starts many into the streets."

1891. Berkeley, October 14; 4:40 a. m.
Slight shock, N. and S.—Professor Soulé.

1891. Petaluma, October 14.
Another lively earthquake shock this morning about 4.30 o'clock, and a much lighter one about 7. The vibrations were north to south.

1891. Suisun, October 14.
Shortly after 4 o'clock this morning the people here were aroused from their slumbers by another sharp, severe shock of earthquake. It was not as severe as the first one that occurred on Sunday night (VI?).

1891. San Rafael, October 14.
Quite a severe shock was felt here this morning at 4.25 o'clock. The shock lasted about ten seconds. The vibrations were from west to east.

Prof. Keep reports that the seismograph at Mills College indicated an actual displacement of the earth in an east and west direction amounting to 1 mm.

1891. October 27; Mount Hamilton; 6:35:43 ± 1s. (Prof. Holden).
Intensity I or II on Rossi-Forel scale. Prof. Barnard reports this as "a decided shock," occurring at 6.35.44.

1891. November 8; Ashland, Oregon.
Following is the newspaper account: "The first time an earthquake has been felt in Ashland for years was last night about 8 o'clock, when a distinct shock, though light and lasting only a very few seconds, caused a general rattling of window panes in many buildings in town. The shock was not heavy enough to cause even timid people any alarm."

1891. November 29; Seattle.
At 3.21 o'clock this afternoon two shocks of earthquake, lasting about five seconds each, were felt here. No damage was done. The direction of the vibrations was southeast to northwest. One building swayed so much that the elevator bumped against the side of the shaft and could not move until the shock was over. Lake Washington, on the east side of town, was lashed into a foam, and the water rolled on to the beach 2 feet above the mark of the highest water and 8 feet above the present stage. Reports from Snohomish and Bellingham Bay towns say the shock was plainly felt there.

1891. Pysht, Washington, November 29; 3:34 p. m.
Duration about ten seconds. Panes of glass broken in the hotel (VI?). (Observer U. S. Weather Bureau, through U. S. Geological Survey.)

1891. Port Townsend, November 29.

A distinct shock of earthquake was felt here at 3.14 this afternoon. The shock continued fully twenty seconds. Buildings shook, windows rattled, and many persons rushed out of their houses. There was no damage done (VII).

1891. Tacoma, November 29.

A slight earthquake was felt all over the city at 3.16 this afternoon. No damage was done. A severe shock but no damage done at Olympia, 15h. 15m., II.—P.

1891. Mendocino, November 29.

Two shocks of earthquake were felt last night at 10.45 o'clock, preceded by a rumbling noise. There were two-minute intervals. Point Wilson Lighthouse, Washington, Nov. 29, 3 p. m. Admiralty Head L. H., Washington, 2.57 p. m. Point No Point Lighthouse, Washington, Nov. 29, 3 p. m., clocks stopped.

1891. December 16; Mount Hamilton; 8:28:12 a. m.

Prof. Schaerberle estimates the intensity at I on the Rossi-Forel scale.

1891. December 21; Mount Hamilton; 6:15:41 ± p. m. (Prof. Holden).

Intensity II on Rossi-Forel scale.

1891. December 23; Berkeley [11? p. m.].

Very distinct record.—Professor Soulé.

1891. December 29; Mount Hamilton; 3:26:56 ± 3s. a. m.

Intensity I to II on Rossi-Forel scale.

EARTHQUAKES ON THE PACIFIC COAST, 1892.

1892. January 16; Mount Hamilton; 7:30 a. m.

Note by Prof. Holden: "Wind from north and northwest. Velocity 61 miles per hour. The motion of the third story of Prof. Holden's house from the wind made a tremor which would have been called II on Rossi-Forel scale. No earthquake."

1892. January 22; Arcata (Cal.).

A shock.—Cal. S. W. Service *Bulletin.*

1892. January 30; Humboldt Lighthouse; 9 p. m.

(Ms. from U. S. Geological Survey.)

1892. February 1, Winchester (Cal.).

A shock.—*Ibid.*

1892. February 3; Portland, Oregon; 8:30 p. m.

A severe earthquake shock occurred here at 8.30 o'clock to-night. Brick buildings swayed and windows rattled, terrifying the inmates, who in many instances rushed into the street. The shock

lasted about thirty seconds, and was probably the most severe earthquake ever felt in this city. As far as known no damage was done (VII).

1892. February 3; Astoria, Oregon; 8h. 27m. p. m.
The vibrations were from southwest to northeast. It lasted about three seconds, causing houses to shake perceptibly, but no damage was done.

1892. February 3; Salem, Oregon; 8h. 32m. p. m.
The vibrations were from northeast to southwest. There were three distinct shocks. Windows rattled and buildings trembled, but no damage is reported.

1892. February 3; Yaquina Head Lighthouse, Oregon.
A light shock about 8.20 p. m. Warrior Rock Lighthouse (Columbia River) a shock Feb. 3, 8.40 p. m., N. to S.

1892. February 5; Mount Hamilton.
Prof. Holden was awakened by a shock and noted the time as 6.27.42 a. m. Intensity = V to VI, Rossi-Forel scale.
Mr. Otto Erle was awake and dressing and noted time 6.27.50 a. m. Direction north and south. Prof. Campbell was awakened by the shock and noted the time as 6.27.50 ± 3s. Intensity, R. F. = V; duration, two seconds; north and south. Rattled windows, washbowls, etc.; rocked bed. Also felt at Niles.

1892. February 23; Carson City, Nevada.
Prof. Friend sends a tracing of an earthquake which occurred between 9 p. m. February 23 and 7 a. m. February 24. He says: "No one here, it seems, has felt it, and consequently cannot give you the exact time." The maximum disturbance being about E. S. E. by W. N. W., having an extreme amplitude of 17° on the plate, with a motion at right angles to this of 7 mm.

1892. February 17; Forestville, Sonoma County.
A shock.

1892. February 23; San Diego.
Earthquake shocks are frequent of late. Near midnight, February 23, the first shock, lasting seventy seconds, cracked walls of buildings, and people were thoroughly frightened, VII. Six or eight more shocks were felt that night, the second shock occurring just thirty minutes after the first one. Nearly every night since there have been one to three slight shocks. So severe was the first shock that the undulations gave many the feelings of seasick patients. Along the Pacific coast from Mexico to British Columbia slight shocks were felt, especially in Oregon and Washington.

1892. February 23; San Diego.

The earthquake which visited southern California just before midnight last night was the worst San Diego ever experienced, and seems to have been more severe the farther south it was felt. In this city a large number of buildings were cracked and the plaster was dislodged, although no houses were shaken down.

There were six or seven quakes after the first severe shock.

Reports from outside the city say that in Paradise Valley a church and schoolhouse, which were built upon stilts, were thrown down and almost totally demolished. A message from Campo says that the first shock, at 11.21 p. m., was preceded by a loud rumbling.

Several sharp tremblings followed in quick succession. The rumblings and shocks kept up at intervals of twenty minutes or more through the night until 4.53 a. m., when a fearful shock, with vibrations lasting twenty-five seconds, accompanied by local rumblings, caused the inhabitants to rush out of their houses in terror. Since 5 o'clock this morning over twenty distinct shocks have been experienced, the last one as late as 10 o'clock. At Jamul the walls of the stone kilns at the cement works were cracked and other damage was done. Rumblings have been heard all day in the hills and mountains thereabouts, and the inhabitants are panic-stricken.

1892. Point Firiuni Station (San Pedro), Cal.; 11:20 p. m.

Sleepers waked; clock stopped, etc. (VI).

1892. Ballast Point Light Station (Cal,); 11:17 p. m., local time.

Direction E. S. E. to W. N. W. This shock lasted 1m. 12s. (counted); clock stopped, etc. (VI). Other shocks at 11.30 p. m. (very light); 12.15 p. m. (very light); 1.16 a. m. (heavier); 2.3 a. m. (very light); 2.35 a. m. (very light); 2.50 a. m. (very light); 3.02 a. m. (heavier); 3.19 a. m. (very light); 3.47 a. m. (very light); 3.59 a. m. (very light); 4.31 a. m. (rumbling); 5.57 a. m. (heavier). [The durations of these later shocks are all given and they are all long, from which I infer that the 1m. 12s. above *may* be too long.—E. S. H.] (Ms. kindly communicated by U. S. Geological Survey.)

1892. Point Loma Lighthouse (San Diego); 11:14 p. m. (standard time).

Lasting one minute; 11.24 p. m., lasting 15 seconds; 11.35 p. m. (light); 11.40 p. m. (light). No damage done.

Messages from Lower California are to the effect that Ensenada, Alamo, and San Quentin experienced the severest shocks within the memory of the oldest inhabitants. At Ensenada buildings swayed to and fro, and the people rushed into the streets, frightened by the unusual noises which followed the seismic disturbance. At San Quentin the Peninsular Railway roadbed sustained considerable damage. The shocks there were simply unparalleled in duration, lasting fully seventy seconds (VII?, VIII?).

1892. February 23; Palm Springs; 11h. 25m. p. m.

It lasted over one minute and the direction of the vibration was southeast to northwest. It was followed by at least eight other shocks, all exceptionally severe. The last shock was at 4.30 a. m.

1892. February 23; Indio; 11h. 16m. p. m.

A severe earthquake. There were five lighter shocks between that time and 11.45 o'clock, and there was one at 12.30 and one at 4.49 a. m. Feb. 24. No damage was done (VII).

1892. February 23; Beaumont; 11h. 20m. p. m.

A severe earthquake. The vibrations were from east to west and lasted several seconds.

1892. February 23; Pomona; 11h. 15m. p. m.

Buildings shook and rocked for a few seconds, but no damage was done; not even a glass broken. The vibration was north and south (V?, VI??).

1892. February 23; Santa Ana; 11h. 15m. p. m.

Eight shocks. The heaviest was at 11.15. The walls of the water-works building were cracked and plastering in several houses was broken. Visitors in all the hotels left their rooms and clocks stopped (VII).

1892. February 23; San Bernardino.

At 11h. 15m. a shock, lasting about one minute and a quarter. The vibrations were northeast and southwest. No damage was done, except to break chinaware and stop clocks. The shock was heavy and was followed by light temblors all night (VI).

1892. February 23; Ontario.

Two sharp shocks at 11.15. The course of the wave seemed to be northeast to southwest. There was no damage.

1892. February 23; Visalia.

A light shock was felt here at 11.40 o'clock p. m.

1892. February 23; Yuma.

Two shocks at 11 o'clock p. m. The movement was from east to west. No damage was done.

1892. February 24; San Diego.

Two more shocks were felt in this city at 2 o'clock this morning, but neither was as bad as those of the preceding night, and no damage was done. They were severe enough to cause a hasty exodus of lodgers from hotels in their night clothes (VII).

At Campo the rumbling and shocks continued last night, but no damage was done. Up to this evening there have been about eighty distinct shocks in that locality since Tuesday night. February 24, Carson City, 7 a. m.

1892. February 24; Ontario.

There were two more, but light shocks, one at 9.30 p. m. and the other at 2 o'clock a. m. The first occurred while a large audience was listening to George W. Cable at Workman Hall.

1892. February 24; Santa Ana.

Two light shocks were felt here about 2 o'clock a. m.

1892. March ? 21h. 30m.

Kalama, Washington.—P.

1892. March 1; 3 p. m.

San Bernardino.—*Cal. S. N. Service Bulletin.*

1892. March 13; Petaluma.

This morning at 5.25 o'clock a distinct shock of earthquake. The vibration was from east to west.

1892. March 13; Napa.

This morning at 8.35 o'clock a rather severe shock. The vibrations were from north to south, continuing about twelve seconds.

1892. March 13; Napa.

This morning at 8.23 came a slight shock of eight seconds' duration.

1892. March 26; Carson City.

Slight shock recorded between 7 a. m. and 6 p. m. Slight tremors all day.—C. W. F.

1892. March 28; Drytown.

A slight shock of earthquake was felt here at 7.30 o'clock this morning. It was accompanied by a rumbling sound. The vibrations from west to east.

1892. April 3; Mount Hamilton.

Prof. Holden reports being waked by a shock. Intensity = R. F. IV. "2.45.0 ± 4s. P. S. T. southeast and northwest. Duration, 1s. to 2s. at least. Wakened. Intensity = III-IV. In second story of brick house."

1892. April 17; Tacoma, Washington.

Two shocks were felt at 2.55 o'clock this afternoon. The second was scarcely perceptible. Buildings trembled. The vibrations were from south to north. There was a severe shock at Olympia at 2.39 o'clock this afternoon which lasted seven seconds. Intensity II at Tacoma and at Castle Rock.—P.

1892. April 17; Portland, Oregon.

At 2.50 o'clock this afternoon two heavy shocks. They lasted about ten seconds each and the vibrations were from west to east. Many persons became frightened and rushed into the street when the buildings began to tremble. No damage.

1892. April 17; Olympia; 2:45 p. m.

Severe.

1892. April 17; Portland; 2:56 p. m.

The observer of U. S. Weather Bureau reports *one light* shock.

1892. April 19.

On the morning of this day in the central portion of the State occurred the heaviest earthquake of the year, and in the localities where it was most severe it was doubtless the worst ever experienced, rivaling that of 1868 in severity, and probably exceeding it in point of property destruction. Three important towns, viz., Vacaville, Winters and Dixon, suffered severely and much damage was done in the vicinity. The second day following brought another severe shock which wrecked many buildings already weakened. It is, perhaps, worthy of remark that these disturbances did not follow the mountain contour of the country, but seemed to have their greatest range east and west or nearly at right angles to the direction of the mountain ranges; crossing the Sierras, they were distinctly felt in Nevada. The loss of property was great.—C. D. P. It is my opinion that this shock was quite as severe as the San Francisco shock of 1868.—E. S. H.

1892. April 19; Mount Hamilton.

"Long period gentle shock—waked sleepers—swung hanging lamps —R. F. = IV to V. 2.49½ P. S. T." (Prof. Holden.) The record on the duplex seismograph shows the greatest motion to have been east and west, amounting to 18.5 mm.; the displacement north and south amounting to 8 mm.

1892. April 19; San Francisco; 2h. 50m. a. m.

Sharp undulating shock S. W. and N. E. Duration 40 seconds.—T. T. The shock was the heaviest experienced since the historic one in 1868.

The greatest result that the shake occasioned in San Francisco was the downfall of the front wall of the Old Academy of Sciences building on the corner of Dupont and California streets. Workmen were engaged in tearing it down. The roof and side walls had been cut away, and to guard against a fall the wall was braced with long timbers. When the quake came the timbers were shaken off and down came several tons of brick and mortar.

The earthquake began with a thump that seemed to knock the earth to the west, then for about three seconds the world seemed to be sliding convulsively back into place. But before it came to rest there was another thump, followed by a lighter one. Altogether it took thirteen minutes for the earth to get over its fluttering. Prof. Davidson happened to be in his observatory. He did not feel the earthquake, as he was just rising from his chair. He knew it was a-quaking, however, by the excitement in the bubbles of the levels. The time was 2.51.41 this morning. The

movement in minute waves was 0.9 second of arc, and the period of the pulsations about three seconds of time and not regular, at times almost subsiding and then starting out afresh. The movement was apparently from the south. This continued for four or five minutes, and in six minutes the amplitude of the waves was

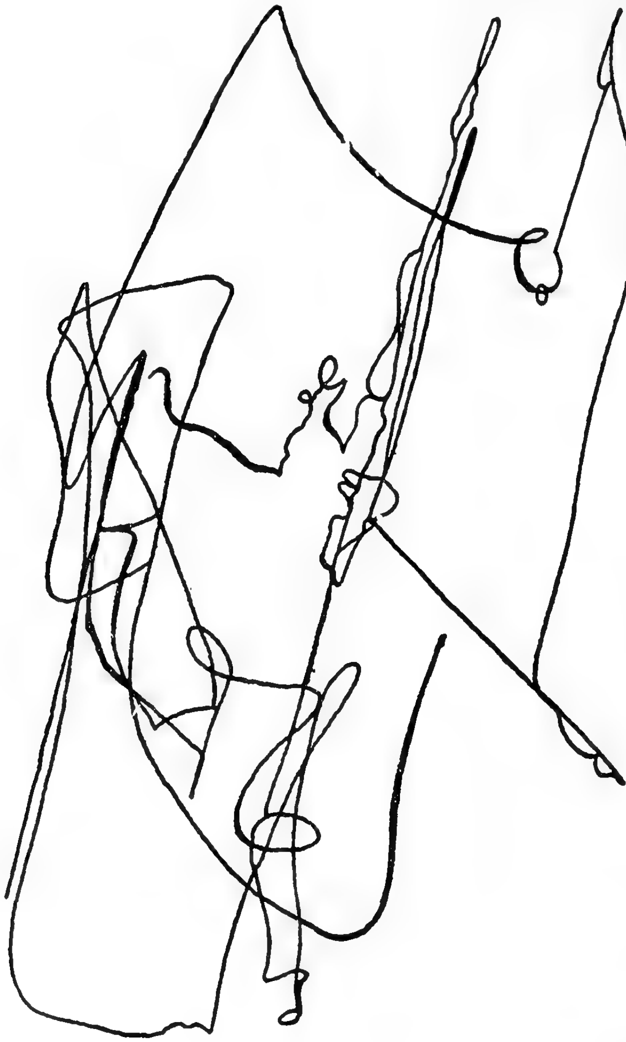

FIG. 1.—Tracing of the seismograph in San Francisco. (Magnified.)

from 0.2 or 0.3 second of arc, and the time of pulsation slower. The pulsation was faintly exhibited for nine minutes and in thirteen minutes it had ceased. At the close the north ends of the two levels were 0.5 second of arc higher than when first read.

Prof. Davidson says that this was one of those earthquakes that

roars, and was the second of that kind that he had observed. Just before the shaking there was a noise as of heavy wagons being hauled over hard ground a long way off.

A distinct shock (2.40 a. m.) W. N. W. and E. S. E. was registered at Berkeley.—Professor Soulé.

Mr. Burckhalter, of Chabot Observatory, Oakland, was ready for it, and his seismograph reduced the earth's movements to black and white. When it registered on this side the curves were replaced by erratic angles.

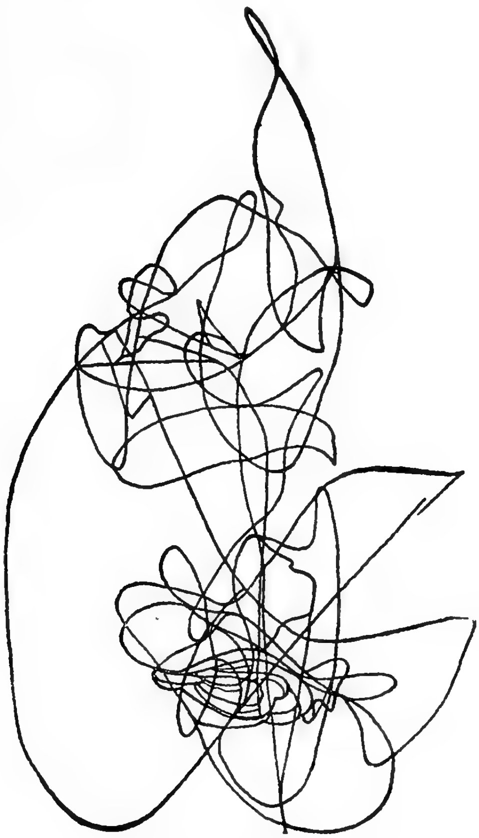

FIG. 2.—Tracing of the seismograph at the Chabot Observatory, Oakland. (Magnified.)

The ferry depot (foot of Market Street) rocked and creaked, and those inside of it started to run for the door. Every clock in the building, including the tower clock, stopped, and all showed the same time, viz., 2.53 o'clock (VI?, VII?). On board the ships a slight trembling was felt that lasted about ten or twelve seconds. The shock was felt only by those who happened to be on deck.

The ferry tower pendulum is between 50 and 60 pounds weight

and is suspended by a steel spring 6 or 8 inches long and three-fourths of an inch wide, similar in appearance to a piece of scrap iron. The shock set the pendulum to wriggling in an irregular manner from side to side and kept it up so long that the strong steel was warped in all sorts of shapes and finally broken.

The guests in the New Western hotel poured out into Kearney Street when the shake took place (VII?).

The guests in the Palace Hotel were somewhat frightened, a number of them rushing into the corridors to ascertain the cause of the vibrations. The only damage sustained was the breaking of a few statuettes and some glass, which were thrown to the floor (VI?).

The shock was very much more severe in the region 50 or 75 miles north of the city, and the residents there had much curiosity to know how great it had been in San Francisco.

1892. April 19.

The *Chronicle* of April 20: The vibration was felt from Gilroy and Fresno on the south to Oroville and Chico on the north, and from Santa Rosa on the west entirely across the State and into Nevada; the area within which damage was done was very small. This district includes portions of Solano and Yolo counties, and comprises a section some 20 miles wide by about 30 in length. Brick buildings in Vacaville, Winters, Dixon, Woodland, Esparto, Capay, and Fairfield were wrecked to a greater or less extent, but the entire damage, by the most liberal estimate, is so small that it is apparent that the injured structures were of a class easily damaged, and no great outlay for repairs or complete reconstruction will be involved. In a few cases injuries to persons are reported, but in no instance were there any seriously hurt, nor was there any loss of life.

1892. April 19; Vacaville.

An earthquake occurred here at 2.50 o'clock this morning. The damage in town was very great, there being few, if any, of the hundreds of residences that do not show evidences of the tremendous power exerted. Chimneys were razed entirely or twisted badly. Dishes, tinware, crockery, and everything of a movable nature went down with a crash that was truly appalling. This statement will as well apply to the whole township as to the town (VIII).

This town presents a strange appearance to-night. There is apparently but one street in it, namely, Main Street, and the south side is nothing more nor less than a row of wrecked brick structures, and the street is filled with pieces of brick and lumber, and the cracked edifices are propped up with huge beams to prevent them from falling into the roadway. The north side of the street was composed in the main of wooden buildings, and except in a few instances the loss on that side is confined to chim-

neys, which went by the run when the memorable temblor struck the town.

The worst cases of damage off Main Street were sustained by W. J. Dobbins, who lived in a two-story brick building about 300 yards north from Vacaville, and by Garland Gates, who lived in a similar structure 3 miles west of the city. Both of the houses were totally wrecked and several persons who were sleeping in them at the time were injured.

On entering the town from the direction of the railroad depot the first demolished building met with on the south or brick side of Main Street is H. Chittenden's grocery store. It is a complete wreck. Next to it is F. H. Hacke's hardware shop, split and rent asunder, and held together only by wooden props leaning in from the street. The bank of Vacaville, a one-story brick structure, did not suffer as extensively as its neighbors. The Odd Fellows' building, which stands next, was badly wrecked; the upper story is thoroughly destroyed, and those who had offices there are heavy losers.

Going west, the one-story brick buildings which adjoined one another were all more or less damaged. Mr. Plates's building at the western extremity of Main Street is in a deplorable condition. It is a one-story brick building. The walls, both front and rear, were knocked out, and the building may be said to be a total wreck. The buildings which suffered most are the Brunswick hotel and the Presbyterian Church. They are wooden structures and are pretty badly damaged.

The total loss in and around Vacaville is variously estimated at from $70,000 to $150,000. There is not a brick building on the south side of the street which was not more or less wrecked, and some of them are a total loss. The shock struck the town at just 2.49 o'clock, and lasted fully three-quarters of a minute. The vibrations were at first from southwest to northeast and then changed suddenly to north and south. Fronts of buildings tumbled into the street, chimneys were twisted and torn as if struck by a Kansas cyclone, and the entire population rushed into the streets. That there were no fatalities is little short of miraculous, though there were a number of very narrow escapes.

Vacaville seems to have been headquarters for the quake. Several have heretofore been felt here, but none ever approached this in severity. The aggregate loss in the town and township will foot up fully $100,000.

Probably the first person in Vacaville to notice the approach of the earthquake was S. N. Bettis, the night watchman of the town. He reports that the morning was clear and starlit and that a cold breeze was blowing. He was walking down Main Street, from west to east, when his attention was attracted by a rumbling sound which came from the hills west of the town. The noise

resembled distant thunder or the roaring of water which had suddenly been let loose by the bursting of huge dam gates. In a few seconds the noise increased to a roar and the ground beneath his feet seemed to heave up.

"The motion at first was west to east," said he, "and then several violent shocks passed from north to south. I felt as if I was on the deck of a vessel during a heavy storm, and I put my hands to the ground to prevent myself from falling on my face. After that brick walls and chimneys began to fall all around and the noise for a minute or so was deafening. Occasionally I could hear the shrieks of women above the din, and soon people began to rush into the streets in their night clothes."

The ground was fissured in many places. The public schoolhouse and the college, a couple of two-story brick buildings near the railroad depot, have also been badly racked. It is thought that the upper story of the school building will have to come down.

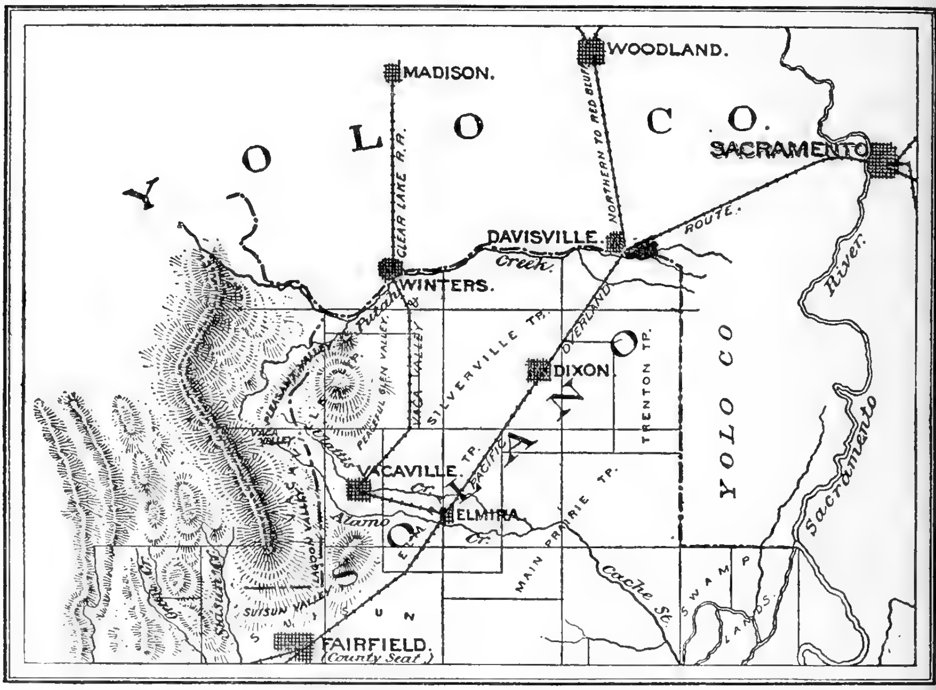

FIG. 3.—Map of Yolo and Solano counties showing the area where the earthquake was most severe.

1892. April 19; Dixon.

At 2.45 o'clock this morning people were awakened by an ominous rumbling, followed almost immediately by a heavy shock and the twisting and groaning of timbers.

Scarcely had the first vibration ceased before a second of shorter duration began. Toppled walls and crushed roofs presented

themselves on every side, and the sidewalks and streets were strewed with wreckage and debris. To add to the terror, fire broke out in several places simultaneously in the midst of the ruins. The damage will amount to many thousands of dollars. If the earthquake had occurred earlier or later there would have been numerous fires from overturned oil lamps, etc.

Many of the finest residences in town are wrecked and not more than five chimneys in the town are standing. The total loss on residences is $6,000. In the country the loss was very serious; hardly a house rests on its foundation and some of them are not habitable. The losses to farmers will aggregate $10,000. Every monument in the local cemetery was either broken or badly twisted and thrown from position.

There were several miraculous escapes from death.

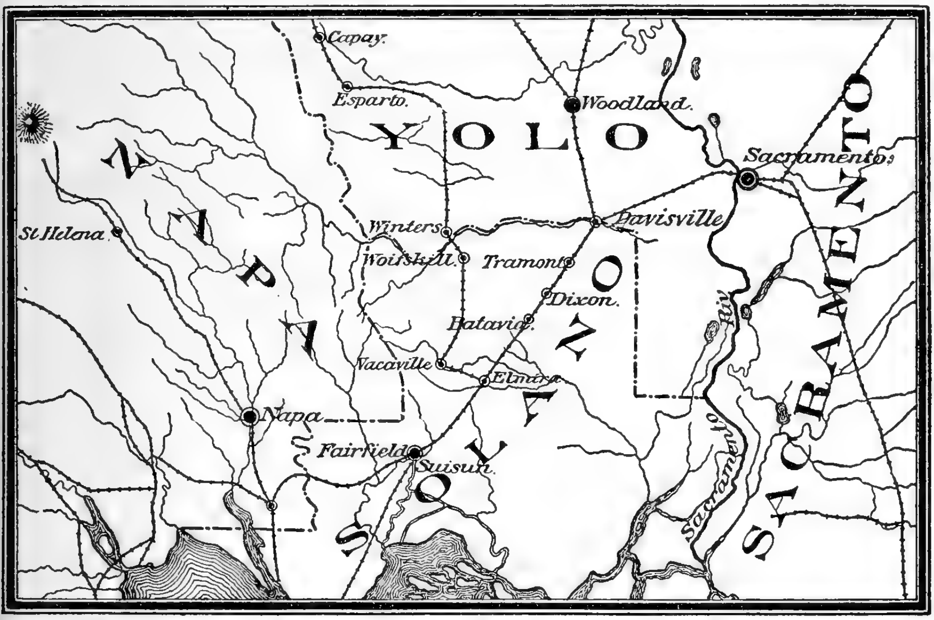

FIG. 4.—Map of Napa, Yolo, Solano and Sacramento counties: the earthquake center.

The schoolhouses are badly wrecked; one, costing $8,000, is twisted off the foundation, and the roof has caved in. The contractors have been making estimates all the afternoon, and it is safe to say that it will cost $75,000 to make repairs—$50,000 in town and $25,000 in the vicinity. The stoppage of clocks confirms the general impression that the main shock occurred at 2.50 a. m. The facts seem to show that the wave traveled much nearer the surface than in the earthquake of 1868, or even in the Napa shock of last year. Every article of glass was turned upside down and

nothing was broken; while at a saloon not half a block away the proprietor did not even know that an earthquake happened till the ringing of the fire bell summoned him to duty—not an article of glass in his place was broken or disturbed.

1892. April 19; Winters; 2h. 50m. a. m.

Every brick and stone building in the town is damaged more or less, and some of them are total wrecks.

The fine new schoolhouse, just completed, lost its chimneys; the plaster is cracked, and the brick foundation is badly shattered. It is estimated that the loss to the town will be from $50,000 to $60,000.

The large new Devilbiss hotel suffered considerably, much of the brick front caving into the street.

Sixty feet of the fire wall of the new Cradwick building on Main Street toppled westward upon the frame roof of Judy Brothers' stable, and crashing through completely buried six horses in their stalls, though singularly not badly hurting them. To-day the schoolhouse, just finished by the contractor, was to have been turned over to the trustees. The brick foundation was cracked, the chimneys thrown to the ground, and the plaster torn. The old schoolhouse is so badly wrecked that no school is being held to-day. The loss to the town is estimated at between $70,000 and $100,000. At the graveyard tombstones were wrenched around or completely shattered. Near the town the bank of Putah Creek, ten feet wide, caved in, and along the bottom of the creek for a great distance rents were made by the shocks. West of here about three miles, an acre of ground slid into the creek.

Two miles southeast of Winters, J. R. Wolfskill's stone house was totally wrecked. In Pleasanton valley a lamp in J. N. Thissell's house was thrown down. It exploded and a fire followed. The house was wholly consumed. In the residence of J. A. Devilbiss the wall was separated from the floor so that a man might put his leg down the aperture. Up the Berryessa road the passage is blocked by immense bowlders, some weighing several tons, which were thrown down the hillsides into the road. It is near this point where the rents in the road were noticed. William Barker's adobe house across the creek was so shaken that it is dangerous to enter it, and other houses were wrenched from their foundations. From all around come reports of wells filling up with caving earth and narrow escapes from awful fires and death by the falling of burning lamps in sick rooms. What is most mystifying in the face of all the damage done is that no lives were lost and very little injury to persons is reported. The bank building on Main Street was wrecked. There is not a whole window left in any house on that street. In the office of the *Express* forms were pied, type emptied from the cases, and the old Washington press, weighing over a ton, knocked over. A big job press suffered similarly (VIII).

On Putah Creek, half a mile west of Winters, a phenomenon was witnessed by a young man named Fred Willis, who was riding past at the time of the big shake. There seemed to be an explosion, and the water was thrown from the creek to a distance of 20 feet on either bank. Then followed a hissing sound as of gas escaping. At daylight several fissures were found in the bed of the creek and in the roadway and fields adjoining. On each side of the creek where the explosion took place the banks caved in, the landslides being 75 feet in length and 12 feet deep.

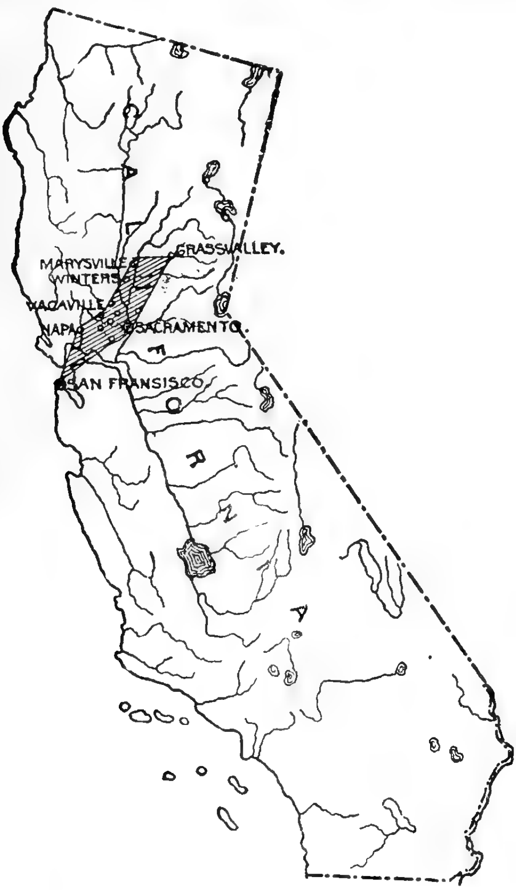

FIG. 5.—The region affected by the shocks of April 19, 1892.

Such as were enabled to see the sky through split roofs after the big shock passed state that the heavens were livid with fire, and when they reached the street there seemed to be a haze in the atmosphere, while odors of sulphur were distinctly discernible. The people of Winters are extremely positive on these points.

1892. April 19; Woodland.

A deep rumbling noise at 2.45 a. m. to-day was the forerunner of the most severe shock of earthquake ever experienced in this portion of the State. The shock was a series of rapidly intermittent vibrations which lasted for thirty seconds, at first almost north and south and changing frequently from east to west, producing the impression of circular motion. Fortunately the casualties in this immediate vicinity are not great, but the public never experienced a worse fright.

Evidences of the force of the shock are numerous everywhere. Chimneys are cracked and occasionally toppled over, brick walls are cracked and fire walls suffer through loss of brick. The destruction of glass in stores and private residences is very large. The Byrnes Hotel loses a part of its ceiling; the Capital Hotel, a chimney; Masonic Hall suffers in chimneys and plaster; Mezgar's bakery furnishes broken glass and cracked walls. The grammar school building suffers a broken fire wall and cornice. So far there is no evidence of any damage to the waterworks. In the Croft Hotel a number of the rooms are almost denuded of plaster, and most of the business blocks are slightly damaged. One of the Capital Hotel chimneys is out of plumb. The walls of both the jail and court room are cracked. The plastering has fallen off in Superintendent's Banks's office. The wall at the southwest corner of the Bank of Woodland is cracked. At the Byrnes Hotel the walls were cracked and the plaster fell to the floor in several rooms. Many of the guests were so badly frightened that they ran downstairs without stopping to dress (VII?, VIII??).

1892. April 19; Grass Valley.

This morning a little before 3 o'clock two shocks of earthquake woke the people and rattled things. The direction was north to south. No damage was done (VI).

1892. April 19; Auburn.

There was an earthquake this morning about 2.45. There were two distinct shocks, about ten seconds apart. The course was northerly. No damage is reported.

1892. April 19; Chico.

A heavy shock of earthquake was experienced in this city at 2.45 this morning, followed immediately by two others. They seemed to pass northwest to southeast. Many clocks in the city were stopped. In some places articles sitting near the edges of shelves were knocked off. No damage was done to the windows or glassware (V).

1892. April 19; Stockton.

A severe shock of earthquake was felt here at 2.50 o'clock this morning. No damage is reported, but the fright was great (V? VI?).

1892. April 19; Nicolaus.

There was a severe earthquake at 2.50 o'clock in the night. The direction was doubtful. A loud rumbling noise followed the shock.

1892. April 19; Merced.

Two distinct shocks. The first occurred at 2.47, stopping the clock at El Capitan Hotel. The second shock was three minutes afterward starting the clock again. No damage was done (VI).

1892. April 19; Marysville.

The duration of the shock was from seven to nine seconds. The vibrations were north of northwest and south of southeast. It was the severest and longest of any ever experienced in this vicinity, but did no damage. Buildings were swayed, bells rung, and clocks stopped.

1892. April 19; Nevada; 2h. 50m. a. m.

Two sharp shocks. The first was of brief duration, but the second, which immediately followed, lasted eight or ten seconds, awakening the soundest sleepers and creating widespread alarm among timid people. The vibrations extended from northeast to southwest (VI).

1892. April 19; Folsom.

The prisoners in the jail were greatly alarmed at the earthquake shocks. No material damage resulted.

1892. April 19; Antioch; 2h. 45m. a. m.

A severe earthquake shock. The vibrations were from west to east and of about forty seconds duration. No damage to property.

1892. April 19; Benicia; 2h. 40m. a. m.

The heaviest shock of earthquake felt in this city since 1868. The vibrations lasted for several seconds and were north and south. The whole town was aroused. Little or no damage is reported here beyond the cracking of a few chimneys and some plastering (VII?).

1892. April 19; Davisville.

The hardest shock of earthquake ever experienced here was felt this morning, but the damage is very slight. One or two chimneys were overthrown and brick houses cracked, but not so as to be dangerous. Perhaps $200 will cover all damage.

1892. April 19; Elmira.

The most severe shock of earthquake ever experienced here occurred this morning at 2.50 o'clock, destroying almost every chimney in the town, and badly wrecking the brick store of J. Allison & Co. The damage is small, as the buildings are all frame (VIII).

1892. April 19; Colusa.

At 2.50 o'clock one of the heaviest shocks of earthquake ever felt at Mills station occurred, lasting about twenty seconds. The vibrations were from north to south.

There were several severe shocks. Opinion is divided as to the direction. Clocks were stopped and there was a general shaking up of crockery (VI).

1892. April 19; Wheatland.

The vibrations appeared to be west to east, and were so pronounced as to awake the soundest sleeper (VI).

1892. April 19; Orland.

Two distinct shocks were felt here about 2.40 a. m. The vibrations were apparently north and south.

1892. April 19; Biggs.

Three heavy shocks occurred here this morning at 3 o'clock. The vibrations were northeast and southwest. Clocks were stopped and plastering cracked (VI).

1892. April 19; Petaluma.

About 2.55 o'clock one of the heaviest and longest earthquake shocks experienced here for some time. The vibration was from east to west, and the duration three to four seconds.

1892. April 19; Suisun.

The severest earthquake ever experienced in this vicinity occurred at 2.52 this morning. The shock, although very severe in Suisun, was not nearly as hard as it was a few miles north and east of town. The principal damage here was to the new Masonic Hall, where the plastering is very badly tumbled down and cracked (VII).

The Methodist Church in Fairfield is so seriously damaged that it will have to be taken down. The bell tower is all down, and the walls of the building so badly cracked and broken as to render it unsafe. The court-house and jail were also slightly injured.

There were also a large number of brick chimneys in Fairfield leveled to the tops of the houses (VII?, VIII?).

The vibrations appeared to be from the northwest to southeast and lasted fully one minute. The damage in this town and immediate vicinity, with the exception of the church in Fairfield, will not exceed $500.

1892. April 19; Sacramento.

Some attempts have been made to make a sensation of the earthquake shock here this morning. The truth is the only damage done was the shaking down of one old chimney and the breaking of a chandelier pipe which had rusted at the ceiling joint. Even

pyramids of wine glasses in the show windows of the crockery stores were not disturbed. In a few old buildings a little plastering was loosened. The shock was lively enough and many persons were frightened, but that was all (VI).

1892. April 19; Fresno.

A shock of earthquake was felt this morning at 2.45 o'clock. No damage was done, the shock being slight, and only sufficient to rattle dishes and disturb those who do not sleep soundly. Not one person in ten felt the shock (IV?)

1892. April 19; Reno, Nevada.

A slight earthquake shock occurred here this morning at 2.50 o'clock. The vibrations were from north to south.

1892. April 19; Virginia, Nevada.

The earthquake was felt here. The vibration was from east to west, but no damage is reported.

1892. April 19; Carson City, Nevada.

Reported by Prof. C. W. Friend as occurring at 2.50.40 a. m., P. S. T. Duration, 30 seconds. The tracing shows a total displacement of the pointer in a northeast and southwest direction of 49 mm., and a displacement in a northwest and southeast direction of 29 mm. (VI); stopped two clocks in the observatory. Gentle, large movement.

1892. April 19; Alameda.

Tracing made by duplex seismograph shows a total displacement in a northeast and southwest direction of 30 mm. and in a northwest and southeast direction of 26 mm. Time, 2.49 a. m.—C. D. Perrine.

1892. April 19; Smith Creek, at the foot of Mount Hamilton.

Time noted by Mr. King, 2.50 ± ½ minute p. m. Prof. Holden reports King's watch right at 10 a. m.

1892. April 19; Willows.

A severe shock at 2.51 o'clock, lasting fifteen seconds. Scores of people are practically homeless here. Reports received within a radius of 5 miles around place the amount of damage up to $200,000, at a moderate estimate.

1892. April 19; San José.

An earthquake of considerable length occurred about ten minutes to 3 o'clock this morning, but it was not severe enough to cause any damage in this city. Its duration was about forty seconds and the vibrations were from east to west. It was not felt by everybody. It started with a jerk and then settled into a trem-

bling with an evenness that seems remarkable and was the cause of much comment. As one person expressed it, "It seemed as if a cradle was rocking."

1892. April 19; Esparto.

The severest earthquake that was ever experienced in this locality took place at 2.50 a. m. to-day. Considerable damage was done, though fortunately no one was injured. The greatest damage was done to the Barnes Hotel. A section of the east wall fell down and a great deal of plastering fell in the rooms. Three chimneys were knocked down, one of them crashing through the roof.

It will take $1,500 to cover the damage to the hotel. The fire walls of Levy and Schwab's building were displaced 5 inches. There was also loss from damaged goods and broken crockery (VII?, VIII??).

The large grain warehouse at this place was also slightly wrecked and the drug store considerably damaged. Other buildings were more or less damaged. The earth opened in several places between here and Capay.

1892. April 19; Capay.

The earthquake gave the town of Capay a lively shake-up. The west wall of B. Waldrich's building caved in and the east wall fell out. The damage is fully $1,000. The stock of merchandise in stores was thrown down from the shelving. The walls of the Nash building were cracked and nearly all the chimneys in the town were thrown down (VIII).

1892. April 19; Santa Rosa.

The earthquake which visited Santa Rosa this morning at 2.50 o'clock was the most severe felt since 1868, and many think it was worse than that. It lasted over a minute, and the vibrations seemed to be of an undulatory nature east to west, and lasted three minutes. Windows were broken in many houses and plaster was torn from some of the houses. A panic prevailed at hotels, guests getting up and running out in their nightgowns. No very serious damage was done (VII).

1892. April 19; Martinez.

This morning about ten minutes to 3 o'clock one of the severest shocks of earthquake ever felt here awoke the slumbering residents. The vibrations seemed to be from west to east, although some seem to think they vibrated from north to south, and lasted about thirty-five seconds. A few cans toppled over in some of our stores, several clocks stopped, a few cracks occurred in the court-house plastering, and several chimneys were shattered (VII).

1892. April 19; Fairfield.

The hardest shock of earthquake ever experienced here occurred at 2.50 a. m. The vibrations were northeast and southwest. Windows and glassware were broken and the stoves and bookcase in the schoolhouse were overturned. The bell tower on the brick Methodist Episcopal Church fell in and the gable end on the north side fell out. The church was ruined. The courthouse and jail were not much damaged. (VII?).

1892. April 19; Napa.

A heavy earthquake shock was experienced here about 2.50 this morning, followed within half an hour by two lighter shocks. The vibrations were east and west, continuing several seconds. People very generally were alarmed, but no damage was done. The shock was the heaviest felt in several years, excepting that of last October.

1892. April 19; Healdsburg.

An earthquake visited this section at 3.10 o'clock this morning. It was one of the most severe shocks ever felt in this locality. The vibrations seemed to be from south to north. There were three distinct shocks, the first being the most severe. The last of them seemed to take a rotary motion. The plaster in several stores was badly cracked (VII?).

1892. April 19; San Rafael.

The severest earthquake shock experienced here in a number of years occurred this morning at 2.50 o'clock. The vibrations were from north to south and the shock was perceptible for about fifteen seconds. No serious damage was done here, but in numerous residences clocks were stopped, crockery thrown from shelves, and water pipes wrenched (VI).

1892. April 19; Marcuse.

The severest earthquake that has been felt in this neighborhood for years occurred this morning at about 3 o'clock and lasted for nearly half a minute. The vibrations were from north to south. No damage has been heard of.

1892. April 19; Vallejo.

The earthquake this morning stopped the two standard clocks in the Naval Observatory at Mare Island, it being the first time they were ever so affected. The heavy mercury pendulum of one of the clocks was swung out on the ledge of the case and was removed with difficulty. The transmitting clock was not stopped (VI).

1892. April 19; Milton.

At 2.45 o'clock this morning two heavy shocks were felt here. The vibrations were southwest to northeast. Buildings trembled and many persons were severely frightened, but no damage was done.

1892. April 19; Placerville.

A very distinct shock of earthquake was felt at 2.50 o'clock a. m. to-day. The vibrations were from east to west.

1892. April 19; Ukiah.

No seismic disturbance occurred in this section.

1892. April 19; Bonita Point Lighthouse; 2:47 a. m.

Sharp shock. Mare Island L. H., 2.47 a. m., wakened sleepers (VI); duration 30 seconds; rumbling noise followed by a shock W. to E. Fort Point L. H., 2h. 51m. 15s., lasting 7 seconds. A "moderate" shock, though it awakened the observer. Many did not feel it (V?). Roe Island L. H., 1h. 50m. a. m., railroad time [should be 2.50]; a severe shock lasting (by watch) fully 45 sec. Brick chimneys thrown down; but L. H. clock not stopped, though disturbed (VII?).

East Brother L. H., 2.50 a. m., lasting 47 seconds, E. to W.; not heavy. Lime Point L. H., 2.52 a. m. (clock regulated by noon time-ball in S. F.); duration about 8 seconds. A tremor rattling windows, etc. (IV?). Oakland Harbor L. H., 2.45 a. m., a strong shock from the W., lasting 5 sec., "shaking dwelling terrifically, etc." (VII?). Yerba Buena L. H., 2.50 a. m., lasting 58 seconds. A very heavy shock.

Angel Island L. H. Felt on the island, but not at the L. H.

1892. April 20; Roe Island Lighthouse, 1:50 a. m.

Slight shock. (The foregoing reports from lighthouse keepers are kindly furnished by the U. S. Lighthouse Board, through the U. S. Geological Survey.)

1892. April 20; Vacaville.

When the terrible shock of Tuesday morning occurred every one expected a repetition. During last night there were constant shocks, beginning about midnight and continuing to 8 this morning. The only effect of to-day's quakes has been to weaken the walls already shaken.

The townspeople of Vacaville have had seven more shocks to unnerve them. The heaviest came a little before 2 o'clock this morning and shook down several walls which were already tottering, but did no other damage. No one has been hurt since the big shock. It is safe to say now that the danger is over, and that it will take $100,000 at least to repair damages.

1892. April 20; Petaluma.

About 10 minutes to 2 o'clock this morning a quick, sharp shock of earthquake passed through Petaluma.

1892. April 20; Napa.

Another shock of earthquake was felt here this morning about 2 o'clock. It was much lighter than that of Tuesday morning. No damage was done.

1892. April 20; Martinez.

A slight shock of earthquake was felt here this morning about 6 minutes past 2 o'clock, but did no damage.

1892. April 20; Stockton.

Timid people who were frightened by the sharp earthquake shocks at 2.50 o'clock Tuesday morning noticed two more gentle temblors at 2.05 this morning. No damage was done.

1892. April 20; Woodland.

There was a slight shock at 2.05 o'clock this morning. No damage.

1892. April 20; Grass Valley.

There was a shock here this morning at about 2 o'clock, lasting twelve or fourteen seconds. No damage.

1892. April 20; Nevada City.

Mild shocks were felt here at 10 o'clock last night and at 2.05 o'clock this morning.

1892. April 20; Suisun.

There were three slight shocks here to-day, the first occurring shortly before 2 o'clock this morning and the last at about 8.30.

1892. April 20; Elmira.

Seven fresh shocks, the heaviest at 2 a. m. and the last at 9 a. m. The vibrations were northeast and southwest. Most of the chimneys went down on Tuesday morning and no further damage has been done.

1892. April 20; Fairfield.

Fairfield had another shake-up to-day, the most noticeable tremor being at 2 o'clock this afternoon. No damage.

1892. April 20; Napa.

Another shock was felt here this morning about 2 o'clock. It was much lighter than Tuesday morning's. No damage.

1892. April 20; Sacramento.

Mild shocks were felt here at 10 o'clock last night and at 2.05 o'clock this morning.

1892. April 20; Winters.

Three small shocks. The hardest was at 2.05 o'clock; the second came a little before 4.30 o'clock and the third at 8.40 a. m.

At Winters there have been developed a number of fissures in the earth, water has been ejected, gas has escaped, and the bed of the creek has been filled up for a distance of over 70 yards. Many of the wells have been filled up by the collapse of the walls.

1892. April 20; Dixon.

This town has had three more shocks since the big one of yesterday, but the people are regaining confidence. Most of the brick buildings that were damaged by the first shock will have to come down.

The shock which came at 2 a. m. was heavy, and it was followed by another of a milder sort at 4 o'clock. At 8.30 o'clock came a third, which was felt lightly all along the line to Benicia.

1892. April 21; Davisville.

At 9.43 this morning another severe shock was felt at this place, the vibrations running from southeast to northwest. It was of brief duration, lasting no more than five seconds, yet in severity it seemed to exceed that of the morning of the 19th. The additional damage is scarcely noticeable. In a drug store several bottles were thrown from the shelves and the glass was crushed in the front. The shocks, fortunately, passed quickly and without the gyratory motion mentioned in that of the 19th, and to these circumstances we are indebted for our slight loss. Families living in brick buildings are looking for other and less dangerous quarters. Many brick chimneys will have to be torn down and rebuilt.

1892. April 21; Winters.

Another slight shock of earthquake was felt here at 3.05 o'clock this morning. No damage resulted.

Another shock of earthquake occurred here at 9.40 o'clock, throwing down the Masonic Hall, Cradwick's building, Bertholet's two-story stone building, Humphrey Bros.' one-story stone building, and generally demolishing goods, fixtures, etc. One man was badly hurt by a falling wall, and Miss Clara Jessen was hurt. Others were more or less injured. Business is all suspended. Main Street is a scene of desolation. A fire broke out but was extinguished.

J. Devilbiss's house, 1 mile west of here, is a total wreck; also Mr. Baker's adobe and J. R. Wolfskill's stone dwellings.

1892. April 21; Woodland.

The shake at 9.40 a. m. continued for thirty seconds. The vibrations were from east to west. The actual damage was not great, but many buildings were wrenched and weakened. Byrnes's Hotel is seriously damaged, the fresco broken, and the walls cracked. Nobody was injured in town. The chimneys on the top of the court-house were rendered unsafe and have been taken down.

The walls of the county jail were badly cracked. The upper story of the Thomas building was badly cracked and the city prison has been rendered unsafe. The Exchange and Craft hotels were

both badly damaged. On Main Street the two-story brick school building was cracked. Experts have examined the building and report it unsafe. Two large plate-glass windows in the Medal bakery were broken. All the stores sustained some loss from the breakage of bottled goods, china and glassware.

Many chimneys were twisted and overturned. The general loss is estimated at $5,000. The wildest excitement prevailed at the time of the shock.

1892. April 21; Nevada City.

At 9.44 o'clock this morning a series of earthquakes, lasting forty-five seconds, were felt here. The waves were from S. to N. The first four were so sharp as to attract the attention of persons afoot and then gradually diminished in force. Doors and windows rattled and some clocks stopped (VI). No damage was done in this section. There was another shaking up shortly after 9 o'clock last night.

1892. April 21; Marysville.

This morning a slight shock at 9.43 o'clock. The vibrations were north and south. One of the public-school buildings was slightly damaged—that is all.

To-night at 7.15 o'clock another shock.

1892. April 21; Grass Valley.

At 9.35 o'clock this morning quite a heavy shock occurred. It sent everybody into the streets. Several brick buildings in the town are cracked (VII?).

A very sharp shock occurred at 7.25 this evening.

1892. April 21; Placerville.

A sharp shock, followed by slight tremors, was felt here at 9.43 o'clock this forenoon. The course was apparently from west to east. No damage to property.

1892. April 21; Chico.

Another heavy earthquake was felt here this morning at 9.47, lasting thirty seconds. The vibrations were north to south. Lamps in buildings all over the city were set swinging. The ceilings in some places cracked and clocks stopped (VI). No damage is reported.

1892. April 21; Biggs.

A very heavy shock occurred here this morning at 9.45. The vibrations were north and south, lasting about eight seconds. Eight distinct vibrations were felt. Clocks stopped and plaster fell (VII?). No serious damage is reported.

1892. April 21; San Francisco.

Quite a sharp shock was felt in this city this morning a few minutes before 10 o'clock. The temblor appears to have extended over a good portion of the central and northern part of the State, though, happily, in most sections no damage was done. In Solano and Yolo counties, however, the destruction was considerable. The town of Winters appears to have suffered most. The earthquake felt in this city to-day extended over a wide area. The disturbance was felt as far east as Reno, as far north as St. Helena, and as far south as Fresno. According to reports, it was of longer duration in the interior than in this city, where the period of vibration was not less than three nor more than six seconds.

Upon the question of duration there is the testimony of two experts with chronometers at their elbows. Mr. F. W. Edmonds, who is employed in the Geodetic Survey Office, noted the time as follows:

	h.	m.	s.
Beginning	9	42	27.4
Ending	9	42	30.2

He noted further that the direction of the vibrations was from east to west.

Thomas Tennant, the well-known nautical instrument maker, was standing with his face to a chronometer. His record is as follows:

	h.	m.	s
Beginning	9	42	30
Ending	9	42	36

Vibrations east and west. Rolling shock.—T. T.

Those in the upper stories of buildings were the most startled, and the effect upon the majority was to make them hasten to their doors, reaching there, however, only in time to appreciate that the critical moment had passed and they were safe. The average clock is very sensitive to jars of any kind, and the earthquake stopped the swing of many a pendulum (V). But no serious damage is reported from any part of the city.

"A light shock was felt in this city at 7.14 p. m. Duration 2 sec." —T. T.

1892. April 21; Vacaville.

Another earthquake was felt this morning, not so severe as those of the preceding days. Some shaky walls were demolished and a number of ceilings cracked, but no serious damage is yet reported. Slight shocks were felt at 6.15 and at 7.23 this evening. There was no special damage done, though the people were badly frightened. Governor Markham has sent twenty-five tents. Occupation of tents is general.

1892. April 21; Martinez.

This morning at 9.44 o'clock a heavy shock was felt here, frightening the residents to such an extent that almost every one rushed into the street. The vibrations were from northwest to southeast and lasted for thirty-five seconds. Clocks were stopped in some parts of the town, the vibrations seeming to be stronger in the level than on the slopes. The court-house was cracked in one or two places, but not seriously (VII).

The brick building used by the free library was cracked so badly that it is considered unsafe. The teachers in the public schools, with the exception of those in one room, became terrified, and told the children to run out of doors, and, in the mad rush, one or two were hurt, but not seriously. No other damage has been reported.

1892. April 21; Elmira.

At 9.40 o'clock this morning there was another very severe shock, badly frightening the people, but doing no damage.

1892. April 21; Benicia.

Quite a pronounced shock was felt here this morning at 9.43. It was nearly as heavy as that of Tuesday morning. Windows rattled, and buildings swayed in a sickening manner. No damage was done here, however. There was a slight shock yesterday morning about 2 o'clock.

Another severe shock occurred at 7.13 o'clock this evening. It was, if anything, more severe than that of this morning.

1892. April 21; Napa.

A heavy shock of earthquake was felt at 9.42 this morning. The shock was even heavier than that of Tuesday morning. Several brick buildings were cracked, and much plaster fell. Nobody was hurt, and no serious damage was done. The vibrations were east and west.

Another shock was felt here at 7.13 o'clock this evening. It was heavy, but no damage was done.

1892. April 21; Petaluma.

At 9.43 o'clock this morning two sharp, quick shocks passed through Petaluma from east to west. The first was light, but was instantly followed by a much heavier shock. Clocks were stopped, and some plastering was shaken down (VI?). Almost everybody went into the streets. Another slight shock occurred to-night at 7.13 o'clock.

1892. April 21; Sonoma.

A shock was felt here this evening at 7 o'clock.

1892. April 21; San Rafael.

A slight shock was felt here this morning at 9.43 o'clock. The vibrations were from north to south. There was another slight shock this evening at 7.10 o'clock, but no damage is reported.

1892. April 21; Sacramento.

A shock was felt here at 9.42 o'clock this morning. The State capitol building was slightly damaged. In the assembly chamber the ceiling was badly cracked, and two statues were thrown from their pedestals. Personal injuries were few (VII).

1892. April 21; Stockton.

At 9.43 this morning Stockton was visited by another shock, which rattled the windows, swung chandeliers, and caused people to run into the streets. No damage was done (VI).

1892. April 21; Woodland.

At 9.46 this morning a low, rumbling sound warned the people of Woodland of the approach of another earthquake, and in less time than it takes to write it the streets were filled with frantic people rushing pell mell in search of a place of safety.

1892. April 21.

The shock was felt with more or less severity at the following points: Colusa, Willows, Marysville, Elmira, Benicia, Chico, Biggs, Merced, Livermore, and Haywards.

1892. April 21; Winters.

A shock this morning has almost completely laid Winters in ruins. Buildings that were damaged Tuesday are entire wrecks and the streets are strewn with debris of the destroyed structures. Seven people were injured (VIII).

1892. April 21; Dixon.

At 9.45 this morning we had a very hard shock of earthquake. Buildings swayed, and the crashing of brick and noise was—(At this juncture the operator who was sending this item added: "I can't stay here any longer as this building is liable to fall any minute.")

1892. April 21; Maxwell.

A heavy shock was felt here about 9.45 o'clock this morning, lasting thirty seconds, vibrations east to west. No damage was done.

1892. April 21; Sacramento.

At 9.45 a. m. a severe shock occurred. The duration was about nine seconds.

Many chimneys came crashing to the ground and glass doors and windows were badly shattered (VIII?).

1892. April 21; Sacramento.

A couple of loose plaster statuettes on the wall of the capitol were thrown off and a small piece of plastering in one room fell. There was no other damage in this city except that two or three old chimneys tipped over. The shock did not exceed three seconds and was east to west and sharp (VII?).

1892. April 21; Esparto.

A terrible shock of earthquake took place here this morning at 9.40 o'clock, completely leveling the brick portion of the town. Every brick chimney was thrown to the ground and wooden buildings were wrenched out of shape (VIII).

An engineer was seriously, if not fatally, injured by a portion of the walls of the blacksmith shop falling on him.

Levy & Schwab's brick store is almost a complete wreck. The entire fire wall and part of the east and west walls are down. Loss to the building and contents, $5,000. The Barnes Hotel suffered severely and has a hole 8 by 6 in the east wall. The bricks crashed through the roof and floor of the balcony and the cement walk was torn out of shape. The loss is $2,500.

1892. April 21; Suisun.

The shock of earthquake this morning did great damage in this vicinity. The brick residence of J. M. Baldwin at Rockville was wrecked, while the stone mansion of L. B. Abernathie and those on the Barbour and Sproul ranches were rendered unsafe for occupancy. The stone church in Suisun valley was also greatly damaged. The plastering in the court-house was ruined, while the walls are considerably cracked. The front wall of the Masonic Temple was also damaged. The few brick chimneys in Suisun valley which withstood the shock of Monday night were all toppled over this morning (VIII).

At 7.15 o'clock this evening another severe shock occurred and twenty minutes later another milder quake followed.

1892. April 21; Healdsburg.

Another severe shock was felt in this city at 9.45 o'clock this morning. The shock was fully as severe as the one felt on Tuesday morning.

1892. April 21; Carson, Nevada.

Two more earthquake shocks have been felt here to-day, one at 9.44 a. m. and another at 7.17 p. m. No material damage has been done in Carson City by any of the three shocks.[1]

1892. April 21; Reno, Nevada.

A slight shock was felt here this morning at 9.45.

[1] 9.44 a. m. E. W. (VI) and 7.17 p. m. (IV), E. W.—C. W. F.

1892. April 21; Lodi.

A shock was felt here this morning about 9.45 o'clock which lasted for fully fifteen seconds. It was not so hard as Monday night's shock. The oscillation was from northeast to southwest.

Another earthquake was felt here this evening at 7.17 o'clock, causing every one in the brick buildings to leave in short order (VI). The one this morning was so heavy it rang the school bell and shook buildings so hard that the plastering fell from several buildings, but none are badly damaged (VII?).

1892. April 21; Acampo.

Quite a severe shock occurred here at 9.45 o'clock this morning. The vibrations were from east to west, lasting about thirty seconds.

1892. April 21; Fresno.

A sharp shock was felt here at 9.46 this morning. It was from northwest to southeast.

1892. April 21; Stockton.

Quite a heavy shock was felt here this morning at 9.45, lasting about ten seconds. The vibrations were from north to south.

Another sharp shock was felt this evening at 7.15 o'clock. Crockery rattled in the dwellings and gas fixtures swung in the stores, but no damage was done (IV?).

1892. April 21; Lathrop.

This place was visited by three distinct shocks to-day; two in quick succession this morning at 9.43 o'clock, and one this evening at 7.15 o'clock, lasting twenty-five seconds. No damage whatever resulted.

1892. April 21; Reno, Nevada.

Mr. C. W. Irish reports as follows: "It occurred at 9.44.15 ± 3s. a. m., one hundred and twentieth meridian time. The direction of the movement was apparently from N. 40° W. towards S. 40° E.; was gyratory, giving a sharp twist to chairs in which persons happened to be seated, and was accompanied by a muffled sound, which seemed to come from the summits of the Sierra Nevada mountains in the exact direction from which the waves came, and preceded them two or three seconds in time. The waves of motion were three in number, lasting about five seconds. No damage was done beyond throwing books from shelves and tables and the displacement of other articles of household furniture." (V).

1892. April 21; Mount Hamilton.

Prof. Holden reports a shock at 7.14.59 p. m., P. S. T. Intensity = III on the Rossi-Forel scale. (It was stronger than this in San José.) Registered on duplex seismograph. Started the clock of the larger machine at 7.31.23, P. S. T., p. m.

The duplex seismograph gives a tracing of the shock at 7.14.59 p. m., with a displacement of the pen in an east and west direction of 4.8 mm., and north and south of 2 mm. It also gives a tracing of the shock occurring at 9.45 a. m., with a displacement of the pen in an east and west direction of 6 mm., and in a north and south direction of 3.2 mm.

1892. April 21; Berkeley.

Principal vibrations N. and S. and E. and W. Duration 10 sec.—Professor Soulé.

1892. April 21; Carson City, Nevada.

Prof. C. W. Friend sends tracings of two shocks occurring at 9.44 a. m. and 7.17 p. m., the former showing a displacement of the pointer of 24 mm. in a north and south direction, and of 25 mm. in an east and west direction, the latter having a displacement of the pointer of 4.5 mm. in a north and south direction, and 6 mm. in an east and west direction.

1892. April 21; Mills College.

Tracings from this station at 9.46 a. m. give a displacement of the pointer in an east and west direction of 23 mm., and in a north and south direction of 16.5 mm. The tracing at 7.15 p. m. shows a displacement in a northwest and southeast direction of 14 mm., and in a northeast and southwest direction of 7.5 mm.

1892. April 21; Oakland,

Chabot Observatory.—Mr. Burckhalter reports a shock at 9.44 a. m., P. S. T., as timed by Mr. F. H. McConnell, lasting fifteen seconds, but doing no damage. The tracing shows a displacement of the pointer in an east and west direction of 14.5 mm., and in a north and south direction of 11 mm. Another shock is also reported as occurring at 7.15 p. m. $\pm$ 2' m., with a duration of five or ten seconds, and causing no damage. The total displacement of the pointer in a southeast and northwest direction of 8.5 mm., and in a northeast and southwest direction of 3 mm.

1892. April 21; Winters.

"The state of affairs in Dixon is bad enough, but in Winters it is simply deplorable. All the lights are out for fear of fire; the hotels and even the saloons are closed, and at this moment a crowd of haggard-looking men and terror-stricken women are standing around a car on Railroad Avenue awaiting the distribution of tents. No one dreams of sleeping in any brick house, and few of the frame houses are safe.

"Two tourist cars came on the same train, having been sent by the railroad company from San Francisco for the accommodation of the homeless ones who cannot get a tent. The work of setting up these tents is going on while I write. A few hand

lamps seem only to make the darkness visible, and it is slow work at the best. There will be many who are too weary to set up the tents, and scores of people are stretched on the ground and even on the doorsteps, too tired to heed the danger of another shock.

"To-day's trouble began at 9.40 a. m. The buildings which had been badly shaken by the Tuesday temblor collapsed at once, and those which had stood the test so long began to yawn, to creak, and to open out in a manner terrible to witness. The north end of the Masonic Temple fell with a crash. Next, the Cradwick building fell in, and the Morrison building followed. All these structures are on the north side of Main Street. On the opposite side the shock caused the Berthollet stone building to collapse, and the Humphreys building shared the same fate. The Devilbiss Hotel, already badly shaken, caved in completely, the front of the bank building dropped, and the pier fell out.

"Among the victims of this shock were a man named Darby, who had his skull fractured, and Miss Clara Jessen, who was badly hurt.

"In the vicinity of town several fine dwellings are utterly wrecked. Main Street is about 400 feet long, and most of the structures are of brick or brick and stone. Not one of them is left in a habitable condition, and it is needless to say that every article of glass and crockery all along this street has been smashed to pieces. The railroad track is all right, and telegraphic communication has been uninterrupted, but there are many nasty cracks and fissures in the roadways, and driving is dangerous.

"The previous estimate of the damages of about $75,000 or $80,000 will have to be increased about 50 per cent. as the result of to-day's shock. The atmosphere is perfectly still, sultry, and oppressive. It may be fancy only, but one feels in breathing it a sense of impending calamity.

"The chief danger is from fire, and this has been guarded against as far as possible by a house-to-house inspection and a cry of "Lights out" wherever an offending glimmer is seen.

"The hotels have been shut up entirely; in fact, it is dangerous to enter them. A bakery and restaurant on Main Street contains a supply of provisions, but it is as much as a man's life is worth to enter it. The proprietor, Peter Graham, has been feeding the people as well as he can during the day, but the street itself is closed in.

"It is quite unnecessary to add that nothing of an exaggerated or alarmist character has been infused into this dispatch. Things are so bad that exaggeration is well-nigh impossible.

"There has been no shock since that at 7.30 p. m., but the suspense is even worse than the shock. It is now 11 o'clock, and as I look down Railroad Avenue I still see the weary ones struggling to

put up the tents. By the light of to-morrow's sun the place will look like an encampment in a ruined city.

"The first object I was shown was the calaboose or jail. There was one man in it, a tramp, when the shock came. He escaped with his life and they let him go on general principles. The jail would be improved in appearance if it had a roof and walls. In the Cradwick building there were three women and a man when the shock came. The women escaped by the front door in the nick of time. The man was the poor fellow sent with a crushed skull to Woodland. The building itself is a heap of bricks, unsymmetrically piled in the center of the lot on which it stood. Morrison's hardware store, next door, has the walls standing, and that is all. By a side alley Main Street was reached, and here the havoc wrought could only be compared to the aspect of Paris during the last days of the Commune. The most furious bombardment could have done no more. Substantially built structures were demolished even more completely than those of lighter order. Some of the granite blocks lying on the sidewalk measured two feet by one, and as for safes and similar heavy objects, they had been tossed about like chaff.

"The encampment was visited. Some of the men were laughing for fear they should cry, and all of them preferred to sleep on the ground with a friendly blanket between them and mother earth, lest they should fall out of bed. Sixteen women were found sleeping in one tent.

"It is quite clear that the focus of to-day's disturbance has been shifted to the north, and has been located near Winters. Elmira and Vacaville got off lightly. The direction of the shocks has also perceptibly changed. It must have been a fearful shock. The sand bars in Putah Creek near Winters opened and from the fissures the water spurted high up on the banks. In some places the creek became dry, in others it changed to a torrent. The banks caved in some places and almost dammed the stream. Some of the farmers say that the earthquake was foretold by the action of the fowls and animals. Horses were restive and neighing, chickens fluttered all about, and dogs whined anxiously for some minutes before the earth trembled. It was reported that several boiling springs had burst from the foothills on the north and west and were flowing steadily. Frame houses did not suffer much in Winters. What was in them was badly shaken up, but the buildings held together as a rule.

"On the Hotel Devilbiss a brick chimney was broken off close to the roof by the shock of the 19th and twisted halfway around. It was not broken more than that, and a couple of men easily twisted it back again and mortared it well. Yesterday's shock simply resolved that chimney into loose bricks and powdered mortar.

"The loftiest structures seemed to those looking on to have suffered most, as their walls fell outwardly, but in the one-story buildings the greatest havoc occurred, for the walls collapsed. Some of the escapes from instant death were exceedingly narrow.

"The bank of Winters is now deserted. Its walls are full of wide cracks, its front is bulged, and piles of bricks lie on the sidewalk. There is not a vestige of glass in the windows, and the stout beams which were placed beneath the doorways a day or two ago to uphold the badly strained building are all awry and look as if a quake of moderate caliber would cause them to snap. The bank will need to be entirely reconstructed, and $5,000 will barely cover the loss."

1892. April 21; San José.

There was a very slight shock felt in San José about 9.43 o'clock yesterday morning. It was one of only a couple of seconds' duration, and many did not feel it (III?). The shock was a little more pronounced in San Francisco, and severe shocks were felt but no damage done at Grass Valley, Santa Rosa, Newcastle, Elmira, Centerville, Fresno, Fairfield, Yuba, Nicolaus, Stockton, Nevada City, St. Helena, Napa, Antioch, Spanishtown, Benicia, Chico, Oroville, Biggs, Gearytown, Gold Run, Red Bluff, Sonoma, Auburn, Willows, Placerville, Downieville, Orland, and Maxwell. There was another light shock here at 7.15 last evening. It was hardly perceptible. Shocks were also reported in the evening fron San Rafael, Vacaville, Lodi, Benicia, and other places in the State, and also from as far east as Carson, Nev. The tremors seemed to be very light and no damage was reported.

1892. April 21; Sacramento.

There was another severe earthquake shock at 9.45 o'clock this morning, lasting twenty seconds. Buildings got a lively shaking and plastering fell from many ceilings.

Several old chimneys toppled over and much glassware was broken in the crockery stores. The State capitol building suffered. A large portion of one of the plaster statues over the portico, 150 feet from the ground, fell and struck 40 feet from the building. The gigantic building trembled violently and the occupants in the State offices were badly frightened, and there was a general exodus of clerks.

It was discovered that a crack was made in the ceiling, extending from one end of the building to the other and going through the office of the superintendent of public instruction into the assembly chamber. The beautiful ceiling of the latter, which is formed of stucco work tipped with gold, was rent in places, as were also the Corinthian columns supporting the gallery. Books were thrown from the shelves and general disorder reigned.

The public schools were dismissed. All the pupils got out without creating a panic. At the city prison the greatest excitement prevailed. A number of police officers rushed into the street, expecting the collapse of the old building. Jailer John McManus stood at his post, with key in hand, prepared to turn loose the prisoners in case the building showed signs of collapsing.

1892. April 21; Dixon.

At 9.40 this morning the people of Dixon were warned of the approach of another earthquake, and the streets were soon filled with people rushing out of buildings in search of a place of safety. Small shocks continued at intervals all day, and to-night the houses are nearly all deserted and people are walking the streets.

The brick buildings are still standing, but every shock cracks them worse, and people expect them to fall down. The frame buildings are receiving so much shaking that many of the occupants have fled to the country for safety.

In the country things are getting to be in a frightful condition. Hardly a farmhouse has escaped injury, and many of them have been moved off their foundations. Most of the occupants have put up tents out in the fields. Reports of damage coming in to-day place the losses much higher that at first estimated, and it is now considered that $100,000 will not cover the loss.

1892. April 21.

Santa Rosa received a severe earthquake shock at 9.40 a. m. to-day. The vibrations were from east to west, and lasted fully fifteen seconds. A deep rumbling sound was heard just before the first movement was felt. There were five vibrations, increasing in intensity to the last, which cracked many brick buildings and precipitated a good deal of plaster to the floor (VII). In two places brick walls were slightly bulged out, iron columns moved, and in some parts of the town chimneys were wrecked.

Many think that the shocks of to-day were much severer than were the shocks of Tuesday morning. The rumble of the earthquake was preceded by perfect stillness in the atmosphere.

The court-house was slightly damaged and everybody in it more or less frightened.

1892. April 21; Suisun.

Two severe shocks and one or two slight ones were experienced here to-day. The first heavy shock occurred about 9.40 a. m. and the next at 7.15 p. m. Although not so severe as that of Tuesday morning, they have terrified the people. All the stores were closed at 7.30 o'clock in the evening. Plaster was torn from many buildings, window panes were broken, clocks stopped, and many chimneys thrown down (VII).

1892. April 21; Madison.

The town was again shaken by the heaviest shock that has been felt, at 9.48 this morning. The total damage is about $10,000.

1892. April 21.

Special cables to the New York *Herald* from Santiago, Chile, under date of April 21, say that during the past week details were received of severe and light earthquake shocks at Taltaval, Serena, and several coast towns.

1892. April 21; Yuba City.

At 9.43 o'clock this morning an earthquake occurred here, but it was not quite so heavy as that of Tuesday. Several clocks were stopped, but no damage occurred (V).

1892. April 21; Nicolaus.

An earthquake occurred here at 9.48 o'clock. The vibration was northeast to southwest. Its duration was twenty seconds.

1892. April 21; Newcastle.

There was a slight earthquake shock here about 5 o'clock this morning and another at 9.43 o'clock. No damage was reported.

1892. April 21; St. Helena.

A very perceptible earthquake occurred here at 9.40 o'clock this morning, sending the people into the streets (V) and stopping clocks. No damage was done.

1892. April 21; Bonita Point Lighthouse; 9:43 a. m.

(Light); 10 p. m. (light). Roe Island Lighthouse, not so severe as the shock of April 19. The vibration lasted 1m. 10s. N. W. to S. E., and was followed by a second shock 20 sec. later. A later report says, April 21, 7h. 16m. p. m. (railroad time): a shock lasting 35 sec., clock stopped, etc. (VI?). Lime Point Lighthouse, 9h. 53m. a. m. (clock regulated by time-ball in S. F.), duration about 2 seconds. Angel Island Lighthouse, 9h. 50m. a. m. (local time). (Ms. kindly furnished by U. S. Lighthouse Board, through U. S. Geological Survey.)

1892. April 21; Fairfield.

The principal damage by the earthquake in this vicinity is the almost total wreck of the Fairfield M. E. Church, a brick building 40 by 60, built in 1861, at a cost of $10,000. The belfry is demolished, the walls cracked and sprung, and will have to be taken down. Many chimneys fell and considerable plastering was thrown down. Several houses were badly injured.

1892. April 21; Red Bluff.

Two perceptible earthquake shocks were felt here this morning. The first was very slight and occurred about 8.10 o'clock. The second stopped several clocks at 9.45 o'clock (V).

1892. April 21; Willows.
Another heavy earthquake was felt here at 9.43 o'clock to-day.

1892. April 21; Orland.
Another slight earthquake was felt here at 10.45 o'clock this morning. The vibrations were northeast and southwest. It was of eight seconds' duration.

1892. April 21; Esparto.
Another shock occurred here at 7 o'clock p. m. Five thousand dollars will cover the total loss.

1892. April 21; Dixon.
At 7.20 o'clock p. m. another sharp shock, but not as hard as the one in the morning. There were several more tremors during the night, but no further damage done.

1892. April 21; Woodland.
Dunnigan, Blacks, and Yolo, all experienced slight shocks in the night, but no further damage is reported.

1892. April 21; Madison.
Slight shocks of earthquake were felt here at 7 o'clock p. m. The total loss here is estimated at $5,000.

1892. April 22; Esparto; 2h. a. m.
A tremor.

1892. April 22; Madison; 2 a. m.
A slight shock.

1892. April 23; Roe Island Lighthouse.
Shocks at 3 a. m. E. to W. (tremor), 4.53 a. m., N. to S., 5.40 a. m., N. W. to S. E.

1892. April 23; Carson City; 5:30 p. m.
S. W. and N. E. (II).—C. W. F.

1892. April 29; Grass Valley; 4h. 10m. p. m.
An earthquake shock lasting ten seconds. No damage.

1892. April 29; Marysville; 4h. 6m. p. m.
A slight shock.

1892. April 29; Vacaville; 4h. 7m. p. m.
A sharp shock. No damage.

1892. April 29; Woodland; 4h. 10m. p. m.
A shock. The vibrations seemed to be north and south. No damage.

1892. April 29; Davisville.
At 4.11 o'clock another shock was felt here, although slight. No damage.

1892. April 29; Carson City; 4:08 p. m.
Very short, S. E. and N. W. (III).—C. W. F.

1892. April 29; Roe Island Lighthouse; 4:04 p. m.
Three shocks.

1892. April 29; Petaluma; 4h. 5m. p. m.
Quite a sharp shock was felt. The vibrations were east to west.

1892. April 29; Winters; 4h. 10m. p. m.
A shock. No damage. The shock lasted about five seconds.

1892. April 29; Santa Rosa; 4h. 10m. p. m.
A very distinct shock. The vibrations were from east to west and were of about eight seconds' duration.

1892. April 29; San Rafael; 4h. 10m. p. m.
A slight shock.

1892. April 29; Napa; 4h. 10m. p. m.
A short, sharp shock. The vibrations were from north to south. No damage.

1892. April 29; Fairfield; 4:10 p. m.
A heavy shock. No damage.

1892. April 29; Benicia; 4h. 10m. p. m.
A very severe shock. No damage.

1892. April 29; Stockton; 4:08 p. m.
A light shock, lasting twenty seconds.

1892. April 29; Haywards.
Two sharp shocks were felt here this afternoon, one occurring at about 4, and the other at 7.35 o'clock. The vibrations were from east to west in each case.

1892. April 29; San Leandro; 7h. 30m. p. m.
A sharp earthquake shock. It was a "twister," seeming to come from all points of the compass. The duration was about 1½ seconds.

1892. April 29; San Francisco; 4h. 10m. p. m.
A slight earthquake shock was felt, but no damage was done.

1892. San Francisco; 4h. 7m. p. m.
Light vibration; duration 1 sec.—T. T.
Fort Point Lighthouse, 4h. 7m. 30s. Very light shock; duration 1½ sec.

1892. May 11; Mount Hamilton; 9:48:32 p. m.

The duplex seismograph shows a displacement of the pen of 1.5 mm. in a northeast and southwest direction, and of 2.5 mm. in northwest and southeast direction, the time recorded by Prof. Holden, 9.48.32 p. m., P. S. T. Intensity = IV on the Rossi-Forel scale.

1892. May 21; Virginia City.

8 p. m., 10 p. m.

1892. May 28; Ontario.

There were two light shocks this morning. The first was at 3.15 o'clock and the second five minutes later. They were heavy enough to stop clocks. The course of the wave was northeast and southwest (VI).

1892. May 28; Santa Ana.

Earthquake shocks were felt here between 2 and 3 o'clock this morning. The first shock was quite heavy and lasted a minute or more.

1892. May 28; San Bernardino.

Two shocks of earthquake were felt here this morning at 3.15 and 3.20 o'clock. The first shock was very heavy, throwing down dishes and stopping clocks (VI). The second was much lighter. The vibrations were from east to west.

1892. May 28; Carson City.

Tremor recorded on seismometer.—C. W. F.

1892. June 9; Independence.

Mr. C. Mulholland reports a disturbance at 3.40 p. m. A rumbling sound was almost immediately followed by the shock, which had an undulatory movement from north to south. The building shook so as to make all loose things rattle, but no harm was done (IV). No damage. Only one shock was felt and that was of short duration, probably lasting not longer than two seconds.

1892. June 14; Riverside.

The heaviest earthquake felt here in many months occurred this morning at 5.30 o'clock. No damage.

1892. June 14; Santa Ana.

A shock lasting nearly thirty seconds. The vibrations were from east to west.

1892. June 14; Pomona; 5h. 25m. a. m.

A sharp earthquake. It lasted a few seconds.

1892. June 14; San Diego; 5:17 a. m.

Quite perceptible shock in this city and county. No damage.

1892. June 14; San Bernardino; 5h. 20m. a. m.

A slight earthquake, lasting at least twenty seconds. It was not severe, but the shaking lasted unusually long. The vibrations were from northwest to southeast.

1892. June 22; Hollister.

Two slight shocks last night.

1892. June 22.

Messrs. Rose and Rikert, in the Santa Clara Valley, near Alamo, Lower California, last Friday, noticed two peaks four miles to the north alternately spouting smoke and flames at short intervals. The eruption was accompanied by rumbling sounds and an occasional quiver of the ground. Though frightened, they stopped long enough to satisfy themselves that two veritable volcanoes had opened. Later travelers report the volcanoes real, but not so active as at first. The region is undoubtedly volcanic, sulphur springs being in the vicinity.

1892. June 26; San Francisco; 5h. 43m. a. m.

N. E. and S. W.; duration 4½ seconds.—T. T.

1892. July 6; Carson City; 7 a. m.

E. and W. tremor.—C. W. F.

1892. July 9.

San Francisco was shaken this morning by a remarkable series of explosions. The giant powder works at Highland Station, fully fifteen miles away, across the bay, exploded, completely wiping out the works, killing five men, wounding more than a score, and causing the effect in this city and Oakland of a severe earthquake. Nothing like the effects of the great shock has ever been known here. The shock caused a rush of air like the first breath of a tornado. Then came a series of shocks attended by a dull roar, like the discharge of heavy artillery at sea. Hundreds rushed out of tall buildings and hotels, pale with fear. Broken glass fell all about them. Scores of heavy plate-glass show windows came crashing into the streets.

The heavy earthquake several months ago was not so terrifying a shock as this. The new high office buildings swayed perceptibly. In old structures plaster fell from the walls and all movable articles on shelves came tumbling to the ground (VII). Seven minutes after the first shock came another, even more severe, which shattered windows all over town, rocked buildings, blew in skylights, broke plate glass on Montgomery Avenue, Montgomery Street, Kearney Street, and other thoroughfares, and caused people to rush into the streets. The consternation was still at its height when two more shocks followed, little less severe than the terrific one which had just been felt. Glass rat-

tled into streets all over the city, and not a few buildings came near collapsing.

The men in the tower of the fire-alarm station were sure that structure was going to go down. At the Palace Hotel there was great fear among the guests, and all over the city there was alarm.

The motion was entirely unlike that of earthquakes. Investigation showed that the giant powder works at Highland Station had exploded, and this had involved the Judson Chemical Works near by. At this writing three white men are known to be killed, two Chinese are dead, and about twenty Chinese are badly wounded. The explosions started in a nitro-glycerine tank about fifty yards from all the other buildings at the works.

What caused this will never be known, for the men who were in the building were blown into fragments. All that saved the 150 men who were at work in the outer buildings was the interval between the original explosion and the next. This was six minutes, and in this time all the hands, white and Chinese, made a rush over the neighboring hill to put that elevation between themselves and the awful death that they knew was so near at hand.

The force of the first explosion was heavy, but it was slight compared with the others. First, the powder-mixing house, about a rod from the nitro-glycerine house, went up in a sheet of flame and with a roar that could be heard clear across the bay. A moment later a storehouse followed, also about one rod distant. The houses all caught from the flames, but full 100 rods farther, over a little hill, were three great magazines of giant powder, black powder and dynamite, all of which were exploded by the concussion. The first three explosions had been heavy, but they were dwarfed by the terrific effect of the blowing up of the first magazine, which contained 350 tons of giant powder. This enormous amount of explosive was in a brick house about 30 by 140 feet, and 20 feet high, lying close to the bank, near the water's edge. In quick succession followed the blowing up of a magazine containing 150 tons of black powder and another containing an unknown amount of dynamite. These terrific explosions caused so great a shock that a large pile of sulphur on a neighboring wharf was set on fire and a vessel that was unloading it was allowed to drift away to save it from the same fate. The force of the explosion wrecked the strong wooden buildings of the Judson Chemical Works a quarter of a mile away. The walls fell in, and the chemicals began to blaze fiercely. Within one hour the large plant of both works was totally destroyed.

The only building of the powder works remaining is a large magazine of gun-cotton which the firemen are trying to save. It

stands some distance from the scene of the explosion. It will probably not explode. No greater scene of desolation could be conceived than that presented after the explosion. Everything belonging to the buildings was smashed into matchwood.

Over the little hill were the cottages of workmen and residences of Judson and his superintendent. Here most curious freaks were seen. One whole side of Judson's house was ripped off, and the plastering was all torn off and covered his fine furniture. In the other house the main stairway was twisted completely around, and one chimney had also been whirled completely about, the top falling off outside. All the little cottages were wrecked so badly that they can never be repaired. All that can be done is to tear them down. The escape of the inmates was miraculous. Only one boy was seriously hurt. He had his arm broken.

One of the largest windows broken in San Francisco was that on the south side of the First National Bank building, corner of Bush and Sansome streets. The Baldwin Hotel was damaged, and windows on several floors were smashed to pieces. The two panes of plate glass in the windows of the San Francisco clearing house, at 211 Sansome Street, were the largest in the city. The one on the south side was shattered into small pieces, and the pane on the north side was uninjured. They were seven-sixteenths of an inch thick, and each cost $600. The glass in most of the windows of the American sugar refinery was broken.

1892. July 9; Berkeley.

Recorded on duplex instrument.—Professor Soulé.

1892. July 9; Alameda.

The explosion of the giant-powder works made a record on my seismograph, the maximum displacement of the pen in a north and south direction being 4 mm. and in an east and west direction 4 mm. (C. D. Perrine.)

1892. July 9; East Oakland.

Mr. F. G. Blinn reports that his seismograph was not in working order, owing to the fact that the soil is adobe, and as it had not been irrigated for some time the working of the soil caused the pen to creak so much that any attempt at records was abandoned. After the powder works explosion the pen was found off the plate on the east side making a nearly straight line, and this would indicate a motion of the ground to the west. (The powder works were about northwest.) A pipe lying on a shelf in the observatory was thrown on the floor to the east, thus confirming the motion of the seismograph. There was an item in the San Francisco *Evening Bulletin* saying that the sealing schooner Emma and Louise, then 150 miles off shore, felt the shock heavily, and it was thought she had struck a rock.

1892. July 9; Oakland.

Mr. Charles Burckhalter reports that the seismograph at the Chabot Observatory showed a V-shaped mark about 4 mm. in height.

1892. July 16; Mount Hamilton.

Prof. Holden reports a shock at 12.6.34 ± p. m. P. S. T. Intensity = III on the Rossi-Forel scale. The duplex seismograph shows a small mark about 1.5 mm. north and south by 1 mm. east and west.

1892. July 22; Carson City; 6:50 a. m.

N. W. and S. E. tremor.—C. W. F.

1892. July 24; Colton.

The San Francisco *Examiner* reports a shock of earthquake at this point at 6 a. m.

1892. July 26; Napa.

"A heavy shock" at 2.10 a. m. Vibrations north to south. No damage.

1892. July 26; Petaluma.

"Quite a lively shock." Vibrations east to west.

1892. July 26; San Francisco.

A slight shock 2h. 8m. a. m. Duration 2 sec.—T. T.

1892. July 26; Mount Hamilton.

The duplex seismograph shows a light shock, the displacement of the pen in a north and south direction being 1 mm. and in an east and west direction 2 mm. The shock was not felt by any one.

1892. July 26; Berkeley.

Slight record.—Professor Soulé.

1892. July 26; Fort Point Lighthouse; 2:04 a. m.

Moderate, lasting 10 sec. A very light shock at 2.59 a. m.

1892. August 1 or 2; Mount Hamilton.

A shock occurred August 1 or 2 and was found recorded on both seismographs, not being of sufficient intensity to start the Ewing instrument, and no one felt it. Displacement of duplex pen northwest and southeast, 4 mm. Almost a straight line.

1892. August 2 or 3; Mount Hamilton.

Another slight shock was found recorded by the duplex, but was not felt by any one here. Displacement of pen east and west, 3 mm. Almost a straight line.

1892. August 5, 6; Mount Hamilton.

A slight shock was found registered by the duplex seismograph, but felt by no one. Displacement of pen north and south, 2 mm. East and west, 1 mm.

1892. August 8-9; Mount Hamilton.

A slight shock was found registered by the duplex instrument, but unnoticed by any one. Displacement of pen north and south, 1.5 mm.; east and west, 2.5 mm.

1892. August 18; Mount Hamilton.

Prof. Holden reports a shock estimated at intensity (V) of the R. F. scale as occurring at 8.8.27 p. m. ± 3s. or 4s. P. S. T. 8.8.23 p. m. standard Pacific time: a diffused shock extending three or four seconds; fairly heavy. Time refers to about middle of shock. (E. E. Barnard.)

1892. August 24; Mount Hamilton.

12.22.14 P. S. T. Decided shock of one or one and one-half seconds' duration. Examining *Mars* at the time. Image of the planet jumped through five or six seconds. The shock consisted of three or four jerks or jars. The motion seemed to be vertical in the telescope. The shock was felt outside of the telescopic vibration. (E. E. Barnard.)

1892. August 25; Mount Hamilton.

The duplex seismograph shows a slight shock, the displacement of the pen being 2 mm. in a north and south direction and 1.5 mm. in an east and west direction.

1892. August 28.

A volcanic eruption of great magnitude took place on one of the Aleutian Islands, Alaska, on August 28. Black Peak, a mountain of great height between Chignik canneries on the Aleutian Islands, and Oonangashik, a station of the Alaska Commercial Company, is supposed to be the volcano in action.

A letter received from Olef M. Olson, sailing master of the schooner Clara, of Sitka, formerly the Ethel, of San Diego, dated from Sand Point, Alaska, September 8, gives the following points:

"On Sunday, August 28, the eruption took place. The Clara was lying at anchor in Chignik Bay abreast of the canneries, and observed a beautiful cloud. It first made its appearance at 4 o'clock in the morning, rose straight in the air from behind the mountains in the southwest until at an angle of about 35°, when it lost its beautiful color, which was blue, and seemed to burst lightly. It remained until after noon, when it got perfectly black. The barometer was all the time steady at 30 inches. About 11 o'clock the earth was shaken heavily. Accompanying the shock were thunder and lightning, which continued all that

day and all the evening. Monday morning when I came on deck my mouth and nose were filled with some stuff that fell heavy and thick about us. The air itself was full of sulphur smoke, which even permeated the cabin, and the decks were covered with fully 2 inches of black sand. Nothing could be cooked because of it. It penetrated everywhere. At noon when the stuff was getting lighter we could see the cannery. We went ashore and found everything one color, black. The schooner Nellie, of Sand Point, coming from Vessnessensky, reported that the storekeeper, N. Zwain, had seen on the day of the eruption, rocks on fire thrown in the air at an angle of 20° in the direction of Portage Bay, which seemed to be a mass of fire and flames. The Alaska Commercial Company's steamer St. Paul experienced the same shower of sand 250 miles off shore that day. On Monday afternoon some stuff, different from what fell on us the night before, came down from the direction of the mountain known as Black Peak, between Chignik and Oonangashik. It appeared more like burned paper. The following day, Tuesday, another light shower fell the whole afternoon. Chignik bay itself had a muddy appearance and all the high grass was knocked down by the heavy sand. It will take some time for the glaciers to get their natural color. The fall was heaviest on Monday morning between 2 and 4 o'clock."

1892. August 30; Tybo (Nev.), 9 p. m.

"Distinct."—C. W. F.

1892. August 31; Independence.

Mr. C. Mulholland reports a shock occurring at 5 p. m. It was quite sharp and was preceded, three or four seconds, by a sound like distant thunder. There appeared to be three or four sharp vibrations coming from the south. No reports of damage.

1892. August 28.

The origin of the immense cloud of volcanic dust which was reported by Capt. Erskine as having passed over the steamer St. Paul on her last trip up to Oonalaska, and which he estimated to be more than 100 miles in extent, has been definitely ascertained. The sea otter hunting schooner Everett Hayes arrived here last week from the Shumagin Islands, and from her owner, I. J. Applegate, the following particulars of the eruption of a new volcano have been obtained:

On Sunday, August 28, the Hayes put into Ivanef Bay at the extreme western end of the Alaskan peninsula, and anchored. The position of the schooner was in lat. 55° 52′ north and long. 159° 20′ west. The weather at the time of anchoring was calm and clear. About midnight of the 27th the crew of the schooner were aroused by a subdued rumbling noise, which sounded not unlike

the steady breaking of surf on the beach. Knowing that such a noise would hardly be heard in the inclosed bay, the captain and Mr. Applegate went on deck to ascertain, if possible, the cause of the disturbance. The night was then calm and clear and not a thing could be seen, so that the two watchers returned to their bunks with the mysterious noise still unexplained.

About 2 a. m. the mate went on deck and shortly afterward reported seeing what appeared to be a small black cloud low down in the northwestern sky. The rumbling noise now gradually increased in volume and soon the whole sky was filled with dense volumes of smoke. Before daylight the crew of the schooner saw a vast column of smoke suddenly shoot straight up to a distance of a mile into the clear atmosphere and then slowly expand in the form of an immense cauliflower from 10 to 12 miles in diameter. From the lower edges and periphery of this black cloud blinding flashes of lightning shot downward toward the base of the column, and the air was filled with almost continuous and deafening detonations as if of thunder. The display was magnificent beyond description. It lasted until daylight. Feeling that the vicinity was anything but pleasant or safe the schooner got under way as early as possible Monday morning, and made her way out into the open waters of the Pacific. A brisk northerly wind swept the smoke cloud clear of the schooner, but the country to the southward must have been covered for miles with ashes and cinders, which fell like a heavy rain from the cloud. At Metrofem, a small native settlement 80 or 90 miles away, the inhabitants witnessed the eruption and distinctly heard reverberations of the thunder, and at all the islands lying to the southward of the peninsula quantities of dust and cinders fell during the greater part of three days.

The exact locality and appearance of the new volcano could not be obtained for the reason that it is inland some 30 miles, as estimated by Mr. Applegate, and hidden from view by the higher mountains which border the sea. It must, however, be of considerable extent, as there can be no doubt now that the rain of volcanic dust which fell on the decks of the St. Paul during five hours of August 28 came from the new volcano. In connection with this upheaval it is of interest to recall the fact previously noted by the *Chronicle* correspondent of the unusual activity of all the volcanoes situated along this part of the Aleutian Islands during this season.

On September 23, while the revenue-cutter Rush was cruising in the vicinity of Akutan Island, the volcano situated thereon suddenly opened up its hidden batteries, and blast after blast of dark purple smoke shot upwards from the crater to a distance of nearly 1,000 feet, accompanied by a rumbling noise like distant thunder. At the same instant, as was subsequently ascertained,

a distinct earthquake shock—something very unusual in this region—was felt at Oonalaska, 30 miles away.

1892. September 8; Petaluma; 4h. 45m. a. m.

A light shock. The vibration seemed to be from east to west. Also felt at Napa.

1892. September 13; San José.

A shock.—Cal. S. W. Service *Bulletin.*

1892. September 25; Stockton.

A shock.—Cal. S. W. Service *Bulletin.*

1892. September 25; Mount Hamilton.

Prof. Holden reports a shock of slow period and intensity = III of the R. F. scale, as occurring at 2.10.43 p. m., P. S. T. The duplex seismograph shows a displacement of the pen of 9 mm. in north-northeast and south-southwest direction, with a displacement of the pen at right angles to this of 3 mm.

1892. September 25; Mills College.

Prof. Keep sends a tracing of the shock occurring at 2.10 p. m. in which the greatest displacement is in a north-northeast and south-southwest direction, and appears to be about 11.5 mm., and at right angles to this the displacement is only 3 mm.

1892. September 25; Alameda.

A shock of earthquake estimated at about (V) of the R. F. scale occurred at 2.11 p. m., the chandeliers swaying for several minutes. The duplex seismograph gives a record in which the displacement of the pen in a northwest and southeast direction measures 77 mm., which is probably exaggerated, although the greatest disturbance was noticed to be in this direction. The displacement of the pen in the northeast and southwest direction is 20 mm. (C. D. Perrine.)

1892. September 27; Napa City.

A shock.—Cal. S. W. Service *Bulletin.*

1892. October 26; San Bernardino; 7h. 5m. a. m.

A slight shock. The vibration was from north to south.

1892. October 30; Mount Hamilton; 12:17:12 a. m.

Southeast to northwest; two slight shocks two seconds apart. Intensity = III. (W. W. Campbell.) The duplex seismograph gives a record of about 2 mm. in both the north and south and east and west directions.

1892. October 30; Independence.

Mr. C. Mulholland reports a shock occurring at 11.53 a. m. The shock was quite heavy and appeared to come from the Sierras

about 6 miles west of the town, but the greatest motion appeared to be vertical or nearly so. Only one shock was felt. The earth rumbling was not very noticeable owing to the rattling of the building. No damage.

1892. November 6; Austin (Nev.).
"Light," E. to W.—C. W. F.

1892. November 12; Niles (Cal.).
1.56 a. m.; 13th, 4.45 a. m., 11.20 p. m., 11.23 p. m.

1892. November 13; 4:45 a. m.
Santa Cruz Lighthouse.

1892. November 13; Mount Hamilton.
Prof. Holden reports two shocks of earthquake close together, of intensity (V) of the R. F. scale.
Time of the second shock 4.45.14 a. m. The duplex seismograph gives a condensed tracing 4.5 mm. by 3.5 mm. The plate is not orientated. Mr. Townley, who was photographing in the Crocker dome at the time of the shock, noted the time (of the first shock?) as 4.44.41, P. S. T.

1892. November 13; Berkeley.
"The earthquake of Sunday was hardly felt here. Very small vibration. Record on duplex and Ewing, but vibration not strong enough to start the seismograph." (A. O. Leuschner.)

1892. November 13; Mills College.
Prof. Keep sends a tracing of the earthquake which occurred at 4.46 a. m., showing a displacement of the pen of 12 mm. in a northeast and southwest direction, and 8 mm. in a northwest and southeast direction.

1892. November 13; Alameda.
A slight shock occurred at 4.48 a. m., giving a tracing on the duplex seismograph, which begins with a displacement of the pen of about 5 mm. toward the southeast and ends with a number of tremors covering an area 2 mm. in a north and south direction by 1.5 mm. in an east and west direction. (C. D. Perrine.)

1892. November 13; Petaluma; about 4h. 45m. a. m.
A lively shock. The vibrations were from north to south. Also felt at Napa.

1892. November 13; Gilroy; 4h. 45m. a. m.
A very heavy shock. It was of several seconds' duration. Clocks were stopped and small articles thrown down. No damage was done to buildings (VI).

1892. November 13; Hollister; 4h. 45m. a. m.

An unusually severe shock. The heavy shock was followed by three of less severity. Aside from the falling of plaster no material damage was done (VI?, VII?).

1892. November 13; Salinas.

At about 4.30 o'clock this morning a heavy earthquake was felt here, doing considerable damage to large window lights, glassware and crockery. The vibrations were from northeast to southwest. They lasted fully forty seconds (VI).

1892. November 13; Monterey.

An extremely lengthy and heavy shock was felt in this city at 4.45 o'clock this morning. The vibration was north and south. It rattled large buildings as if they were chips, shaking crockery and glassware off the shelves, cracking chimneys and playing havoc in general. The oldest citizens say that they have never experienced such a heavy tremor as they felt this morning, the shock being of ten seconds' duration and followed by smaller ones (VII).

1892. November 13; San Rafael; 4h. 46m. a. m.

A shock lasting eleven seconds. The movement was from north to south.

1892. November 13; San Francisco; 4h. 45m. a. m.

Light shock, E. and W., duration 3s.—T. T.

1892. November 13; San José; 4:46 a. m.

Lasting 6 to 8 seconds.

1892. November 24; San Francisco; 0h. 10m. a. m.

Light shock, duration 2 sec.—T. T.

1892. November 24; Niles; 12:07 a. m.

1892. Berkeley; 7h. $9\frac{7}{10}$ m. p. m.

Record on Ewing instrument. Clock started.—Professor Soulé.

1892. November 25; Austin (Nev.).

E. to W.—C. W. F.

EARTHQUAKES ON THE PACIFIC COAST, 1893.

1893. January 13; Mount Hamilton.

Prof. Holden reports the shock at 1.2.22 $\pm$ 5s. a. m. of intensity (V), Rossi-Forel scale.

Mr. Colton reports the time as 1.2.25 a. m.

Mr. Townley reports the time as 1.2.16 a. m.

The duplex seismograph gives a complicated tracing, 5 mm. by 3 mm.

The Ewing instrument shows a motion east and west in the horizontal, but none in either the north or south or vertical directions. The greatest amplitude of the Ewing *record* is 3 mm., the shock lasting fifteen to twenty seconds. Mr. Colton's record shows that the first motion of the earth was to the east.

1893. January 24; Winters; 9h. 40m. p. m.

1893. January 25; Winters; about 1 a. m.

A shock last night at 9.40 and another about 1 this morning. Both were light, but pronounced enough to scare the timid.

1893. February 15; Berkeley; 3h. 15m. a. m.

Slight records.—Professor Soulé.

1893. February 16; Berkeley.

Slight records.—Professor Soulé.

1893. February 16; Sydney, Washington.

II.—P.

1893. February 21; Fairfield.

A heavy shock at 8.15 p. m. to-day.

1893. February 21; Suisun.

A sharp shock at 8.16 o'clock this evening.

1893. February 21; Dixon.

Quite a severe shock at 8.20 o'clock this evening.

1893. February 22.

It was felt at San Rafael at 8.15 (a. m.? p. m.?).—Professor Soulé.

1893. March 3; Grass Valley.

" A perceptible shock " at 6.15 a. m.

1893. March 3; Carson City; 12:05 a. m. and 6:40 a. m.

E. and W.—C. W. F.

1893. March 3; Nevada City; 6:40 a. m.

Iowa Hill, 6.38 a. m.

1893. March 6; Umatilla, Oregon.

A succession of shocks were felt here to-night. One of the walls of a large stone building was thrown down by the force of the shock (VII?, VIII?).

1893. March 12 and 13; Berkeley.

Slight records.—Professor Soulé.

1893. March 18; Shelter Cove, Cal.

Thirteen shocks, N. and S.—Cal. S. W. Service *Bulletin*.

1893. March 27; Santa Rosa.

A slight shock at 11.30 o'clock to-night. The vibration was from east to west and the shock was of only a few seconds' duration. No damage.

1893. March 30; Independence and Lone Pine, Inyo County.

Mr. C. Mulholland reports: "On the evening of last Thursday, March 30, at 10.30 o'clock, an earthquake occurred. The center of disturbance appeared to be about 9 miles north from the south end of Owens Lake. At that point there is a strip of land 2 miles wide between the lake and the base of the Sierra Nevada on the west. But one shock was felt; this was very sharp; the earth motion may be likened to the result of a blow struck upon a plank by a sledge. At Lone Pine, 30 miles farther north, the shock was felt about the same time; the vibration was not so sharp, but more undulatory. No damage."—Carson, March 30, during the night, N. E. and S. W., tremor, from seismometer.—C. W. F.

1893. March 31; Vacaville.

A sharp shock at 2.30 this morning. It lasted several seconds, and its direction was from north to south.

1893. April 4; Mojave.

At 11.40 a. m. to-day this place was visited by four distinct shocks of earthquake. Buildings were rocked for several seconds, creating considerable fright (VII?). At Saugus, 70 miles south, chimneys were knocked down and dishes and other household furnishings were broken (VIII?). The impression is that the shock came from the northeast.

1893. April 4; San Bernardino; 11h. 40m. a. m.

A heavy earthquake, moving in a southeasterly direction. No damage.

1893. April 4; Santa Ana; 11h. 45m. a. m.

A slight earthquake was felt, the movement seeming to be from west to east. The vibrations were so slight, however, that many people were not aware there had been any disturbance of the earth's surface (III).

1893. April 4; Los Angeles.

At 11.48 this morning there was a slight earthquake of short duration. The movement was from west to east. In Observer Franklin's office the barometers were well shaken, and continued to oscillate perceptibly for two minutes at least. It lasted about eighteen seconds (III?).

1893. April 4; San Diego; 11h. 42m. a. m.

A slight shock. It was felt only in the upper stories. It shook the barometer at the signal office (III?).

1893. April 4; Duarte; 11:30 a. m.

Light shock, E. and W.—Cal. S. W. Service *Bulletin.*

1893. April 4; Ventura; 11:44 a. m.

"Heavy."—*Ibid.*

1893. April 4; Nordhoff; 11:30 a. m.

"Heavy."—*Ibid.*

1893. April 8; Los Angeles.

Alarming reports of seismic disturbances have just been received from the oil region of Newhall, 35 miles from this city.

Dating from last Tuesday, the day on which Los Angeles experienced a slight shake, there has been a terrifying series of temblors, accompanied by subterranean explosions. These disturbances have been frequent, and have been accompanied by landslides from the mountains of an alarming and dangerous description. A letter dated from Pico Canyon, about 8 miles southwest from Newhall, reads substantially as follows (and refers to the shock of Tuesday, April 4).

"I was driving this morning when my horse became frightened without apparent cause, and there came a rumbling sound which grew terrifying. I looked up and saw an awful sight. Landslides from every peak in sight came tumbling down with huge bowlders. The mountains appeared as if myriads of volcanoes had burst forth. When I got to the long bridge I saw Mr. Thomas standing dazed, holding to the railing, and others came running across the bridge. The earth opened in a number of places and the scene was indescribable. Men cried, prayed and swore. When I reached my house I found everything upset. Pictures, dishes, and everything breakable were smashed, and two stoves were broken all to pieces. All the afternoon lighter shocks continued, and also through the night" (VII).

Another letter dated on Friday, April 7, says:

"On Wednesday night, just as I had gone to bed, 'Crash!' came another great shock. All night long they recurred, keeping us up until morning; and all day Thursday they continued, each preceded by a heavy subterranean explosion. The house the foreman lived in was demolished this time. Last night was less exciting, and at 3 o'clock this (Friday) morning we had another, which was fully as terrifying as the first. The shocks were worse in the canyon here than elsewhere, but at Newhall and all around this part of the county they have been terrifying" (VII, VIII).

1893. April 9; Los Angeles.

The San Fernando range of mountains, where the greater disturbance took place during the week, were pretty generally shaken up every day, beginning with Tuesday. The last temblor, a

slight one, was felt in the canyon about 10 o'clock Sunday night. There were no shocks so severe as the first one, and they gradually lessened in force and frequency.

As far as can be learned the area of the temblors was not confined entirely to the San Fernando range, but dipped across the big Newhall ranch, past Saugus and over into the Castac and Piru mountains, north of Newhall. Strange as it may seem, although Newhall is only 8 miles from the Pico Canyon, where the shakes were more continuous than elsewhere, the people in that town did not feel many of them.

The greatest disturbance was in and around the oil wells of the Pacific coast and San Francisco companies at the head of Pico Canyon.

Mintryville is a little town with a schoolhouse, and is the residence of the superintendent of the oil companies. Scattered about are pretty little cottages, the homes of employés.

One who has not visited the peculiarly formed canyon can hardly have a clear conception of the consternation with which the earthquakes were received by the 130 people who live in this vicinity. Temblors that would, as these did, tilt up great oil tanks full of oil, detach immense bowlders from the mountain sides weighing tons, and cause big surface fissures in the ground in various places, are not calculated to make people rest well at night, and when these disturbances continue at irregular intervals for five days it is a wonder that the women and children in the canyon bore the ordeal as bravely as they did.

Mr. Mintry gave his recollection of the big earthquake of Tuesday (April 4):

"It was a few minutes after 12 o'clock. The men had nearly all left the derricks. Suddenly there was a peculiar swaying of the ground and an explosion which I can hardly describe. It was heavier than any blast I ever heard. I was on horseback, and the horse was frightened very badly. At first I thought of a boiler, but looking along the San Fernando range, as far as I could see east and west, there was a blinding cloud of dust. It rose directly up from the top of the range and was thick. All around me the dust rose from the hills in the near vicinity and earth and bowlders came tumbling down. The shock lasted between ten and fifteen seconds. I looked across the valley and saw the same thing in the Castac Hills. That shock was the worst and it was accompanied by a rumbling sound. The shocks since that time have been smaller ones. They have not affected the flow of oil. There was not the slightest disturbance in any of the wells. I have been here for nineteen years as superintendent of the oil wells, and this is the first time there has been an earthquake in this vicinity."

At the head of the canyon and at Mintryville, which is nearly 2 miles below, the first shock played havoc with the crockery in nearly all the houses in both places, and a lot of milk pans full of milk, a quantity of eggs, and the stove and nearly every loose article in one house were thrown in a jumble on the floor and mixed up with the ashes (VII).

The schoolhouse had a large brick chimney, and after the shake there was not a whole brick left (VIII?). An immense stone came tumbling down a mountain side and landed in among the pipe lines and tanks below, smashing things generally.

Strange to say, not one of the many huge derricks, which are from 40 to 70 feet in height, was overturned, although they swayed in an alarming manner (VII).

The motion in all the shocks was a swaying motion, and the direction was from northwest to southeast. An old and strong adobe house on what is known as the middle Newhall ranch, northwest of Newhall, was shaken completely down by one of the temblors (VIII).

1893. April 6-8; Albuquerque, N. Mex.

The inhabitants of the river towns south of the city are much alarmed. During the past forty-eight hours the earth has frequently shaken. The depot at Las Lunas shook to such an extent early this morning that the agent fled in terror (VII). The Indians living in the valley are also much excited. No earth tremors have been felt here (*i. e.*, at Albuquerque).

1893. April 8; Albuquerque, N. Mex.

Las Lunas, Belin, and several other towns along the Rio Grande River are all in excitement over what appears to be a series of infantile earthquakes. Four shocks have been distinctly felt since Thursday (April). There was one this morning, attended by ominous rumbling underground and of three seconds' duration, during which time eight or ten vibrations were felt. Glass was broken, dishes rattled, and a few frame houses in the towns swayed as if shaken by a terrible windstorm (VI?, VII?).

1893. April 13; Hydesville.

A shock was felt here at 5 o'clock this morning. It was followed in fifteen minutes by another and severer shock, lasting fifteen seconds, and this was followed in fifteen minutes by another heavy shock. Four shocks between 3 and 6 a. m.

1893. April 13; Eureka.

A light shock was felt here this morning at 5.10. No damage.

Cape Mendocino Lighthouse felt the shock of April 13, though there is no separate report of it.

1893. April 13; Humboldt Lighthouse; 5:12 a. m.

A severe shock lasting 10 or 12 seconds. Direction N. E. to S. W. A second shock 3 or 4 minutes later.

1893. April 21; San Rafael; 11h. 15m. p. m.

A slight shock. The vibrations were from north to south.

1893. May 10; Duarte (Cal.).

A shock.

1893. May 18; Santa Barbara; 4h. 35m. p. m.

A distinct shock. Buildings shook so that the people in the second stories ran out (VI). No damage. The vibrations were from northwest to southeast.

1893. May 18; Point Conception Lighthouse; 4:30 p. m.

Duration 10 sec., followed immediately by a second shock, duration 3 sec. Angel Island Lighthouse 10.01 a. m. (local time), duration 2 sec. Point Fermin Lighthouse, 4.35 p. m. (standard time), duration 34 seconds. Moderate; light objects overthrown (VI?), N. W. to S. E.

1893. May 18; Berkeley; 9:45 a. m.

Slight record; also noticed by laborers on the grounds.—Professor Soulé.

1893. May 18; Saticoy; 4h. 36m. p. m.

Three distinct shocks, lasting for forty-three seconds, with vibrations from north to south, causing dishes to rattle and hanging lamps to swing to and fro (VI).

1893. May 18; San Pedro; 4h. 35m. p. m.

Two distinct shocks of about six seconds' duration, from north to south.

1893. May 18; Santa Ana.

The earthquake at 4.25 this afternoon was one of the hardest ever felt here, but no damage was done. A few people above the ground floors started for the streets, but it was a momentary fright only (VI).

1893. May 18; Lompoc.

A shock was felt here at 4 o'clock this afternoon. The vibrations seemed to be from east to west. No damage.

1893. May 18; Ventura; 4h. 35m. p. m.

A very distinct shock, lasting about fifteen seconds. The oscillation was east and west. Many people ran out of their houses (VI?, VII?).

1893. May 18; Oakland.

Yesterday morning at 10.03 o'clock two severe shocks of earthquake were felt in Oakland. The buildings on Broadway were shaken quite hard, and some of the people ran into the street (VI). (May 19).

1893. May 18; Carson, Nev.

The monthly review of the Nevada State Weather Service for May, 1893, reports a shock on May 18 at 2.55 p. m. Mr. C. Mulholland reports from Los Angeles under date of May 18, as follows: "It is now 4.30 p. m., and an earthquake has just strongly shaken the building. Furniture in the room vibrated so much as first to attract my attention. The motion appeared to be from west to east. There were several—four to six—short, jerky vibrations. No damage observable" (VI?).

1893. May 26; Mariposa.

A shock.

1893. June 1; Santa Barbara; about 4h. a. m.

Another earthquake, which lasted several seconds. It was considerably heavier than the one two weeks ago (VII?).

1893. June 1; Ventura; 3:50 a. m.

Nordhoff, 4 a. m., lasting 20 sec. Also shocks at 4.02 and 4.10 a. m., both lighter.

1893. June 6; San Francisco; 9h. 25m. a. m.

The shock was felt all over the city. Buildings shook, windows rattled, and men employed in down-town houses rushed out to see what it was all about.

The shock was felt very differently in different parts of the city. On Telegraph Hill and on Pacific Heights it was felt very much more than in the Mission and on lower ground.

Its motion was from east to west. In Oakland it was considered to be more than usually severe.

In the office of Prof. Davidson, in the Appraisers' building, a curious occurrence was noted. There were three men in the room. One was standing and facing west at the moment the shock came. The other two were sitting, one facing south, the other north. While the two men who were sitting felt the earthquake and thought it a severe one, the man standing did not feel it at all. The earth trembled only for two seconds.

1893. June 6; Alameda; 9h. 30m. a. m.

Quite a shock.

1893. June 18; Santa Rosa; about 5h. a. m.

A slight earthquake. The vibrations were quite distinct, but no damage was done.

1893. June 30; Vallejo; 5h. 30m. a. m.

Two pronounced shocks created considerable excitement for the few moments they lasted. The first shock was felt at 5.30 o'clock, and was closely followed by the second, which awakened people and was accompanied by a distinct rumbling noise (V?, VI?). The vibrations lasted about two minutes. No damage was done beyond the breaking of crockery.

The shock was quite noticeable on Mare Island.

1893. June 30; San Rafael; 5h. 35m. a. m.

A heavy earthquake. The shock lasted upwards of seven seconds. The vibrations were from north to south. Some glassware in some of the hotels in and around town was broken (V?, VI?).

1893. June 30; Petaluma; 5:30 a. m.

A slight shock. The vibration was from north to south and was of short duration.

1893. June 30; Niles; 5:30 a. m.

N. to S., duration 10 sec.

1893. June 26-30.

The San Francisco *Call* of July 7 contains a story of terrible earthquake shocks and other calamities experienced on San Nicolas Island (one of the Santa Barbara group, off San Diego, some 70 miles) as brought by the captain of the steamer Jennie Griffin, but further investigation renders it very doubtful whether any great disturbance occurred.

1893. July 1; Lakeport.

A shock.

1893. July 12; Albuquerque, N. Mex.

Three shocks of earthquake that shook, from west to east, every house in the city and vicinity and every movable article were distinctly felt here this morning between 6 and 7 o'clock. The chandeliers in the Commercial Club, a stone structure, rocked for at least ten minutes, and the early risers at the club became very much agitated (VI?). A number of clocks throughout the city stopped (VI?). The wave came from the west.

1893. July 12 and 22.

Shocks at Arcata and Hydesville, Cal.

1893. July 21; Napa City.

A shock.

1893. July 22; Cape Mendocino Lighthouse; 1:20 a. m.

Light shock. (Ms. communicated by U. S. Geological Survey.)

1893. July 24; Tomales (Marion Co., Cal.).

A shock.

1893. July 30; San Francisco; 1h. 30m. a. m.

A short, sharp shock. The motion was from the southwest.

1893. July 30; Oakland; 1h. 30m. a. m.

Two light shocks, with scarcely a second elapsing between them. No damage.

1893. August 5; Mount Hamilton; 9h. 16m. p. m.

A very light shock started the clock (only) of the Ewing seismograph at 9.16 p. m. and registered on the duplex as a very simple tracing of only one or two vibrations nearly east and west, the maximum amplitude of the tracing being 2.5 mm. It was not felt by any one at the Lick Observatory.

1893. August 9; San Francisco; 1h. 15m. a. m.

A sharp earthquake shock. Messages from Santa Rosa and Sacramento state that it was quite severe in those places. So far as known no damage was done. 1h. 12m. a. m. Sharp shock. Duration 8s.—T. T.

1893. August 9; San Diego.

Two slight shocks were noticed by the local observer of the weather bureau to-day, one at 11.02 a. m., the other at 4.07 p. m.

1893. August 9; Alameda.

Quite a sharp shock was felt at 1.15 a. m., Mr. Perrine's duplex seismograph giving a tracing 5 mm. in a northwest and southeast direction, and at right angles to this 1.5 mm.; also felt at Berkeley.

1893. August 9; Petaluma.

A lively shock of earthquake was felt in this city at 1.10 this morning, followed for some time afterwards by tremors. In all, six shocks were felt, the first being the heaviest. It was the most severe felt here for years. The vibrations were north to south, and lasted fifteen seconds. No damage is reported, but several clocks stopped, plaster cracked, and crockery was thrown from the shelves. Many people were badly frightened (VII).

1893. August 9; Santa Rosa.

The severest earthquake felt here since 1868 occurred this morning at 1.12 o'clock. The oscillations were apparently southeast and northwest. Considerable damage was done in the way of falling chimneys, broken windows, etc. The court-house was badly shaken up, and the plastering extensively damaged (VII?, VIII??).

1893. August 9; Sonoma.

The residents of this valley were awakened at 1 o'clock this morning by a heavy shock of earthquake (VI?, VII?). 1.15 a. m. at Napa; 1.13 a. m. at Petaluma.

1893. August 9; San Rafael.

This morning at 1.10 o'clock, two severe earthquake shocks were felt. The vibrations were from east to west. The second shock was the heaviest.

1893. August 9; Healdsburg; 1h. 10m. a. m.

A sharp shock, or rather three continuous shocks. The sky, which was clear, was in a few minutes overcast with fog clouds—something not witnessed here for several weeks, although usual in summer.

1893. August 9; San Francisco.

Yesterday morning the Catholic churches of this city celebrated the feast of St. Emigdius. High mass was celebrated in the principal places of worship in honor of the day, with the especial object of obtaining the protection of St. Emigdius and his prayers to Almighty God, asking for his protection against the calamity of earthquakes, for he is patron against such disastrous visitations.

This observance with high mass was introduced by Archbishop Alemany after the alarming earthquake which visited this city in 1868, and has been celebrated in most of the Catholic churches in the United States since that time, and received the sanction of the Pope.

1893. August 12; Mills College.

Prof. Josiah Keep sends a tracing of a slight but quite sharp disturbance recorded on his seismograph at 12.50 p. m. The record shows a displacement of the pen amounting to 5 mm.

1893. August 12; Alameda.

A very slight shock was felt about 12 m. Mr. Perrine's duplex seismograph gives a tracing of but a single vibration.

1893. August 14; Toutle River, Washington.

Mr. Fred G. Plummer reports: "Earthquake at 5.07 a. m., N. 40° W.—11 miles from summit of Mount St. Helens. One sharp shock *vertical*. Intensity IV. Distinct rumbling preceding for four seconds, near at hand toward the mountain." At Green River Mines, Washington, IV, lateral, rumblings.—P.

1893. August 16; Austin (Nev.); 12:30 a. m.

Two shocks.

1893. August 27; Cape Mendocino Lighthouse; 9h. 34½m. p. m.

Clock pendulum nearly stopped (VI), but was again started by the observer.

1893. August 30; Candelaria (Nev.); 10 a. m.

Duration 3 sec., N. W. to S. E.

1893. September 1; Santa Cruz Lighthouse; 11:16 p. m.

Waked sleepers, etc. (VI). In the town of Santa Cruz, 2 miles distant, the shock is described as unusually heavy; vibrations there were N. to S. (Ms. communicated by U. S. Geological Survey.)

1893. September 1; Gilroy.

A sharp shock of earthquake occurred to-night at 11.20 o'clock. It was of several seconds' duration. Niles 11.17 p. m.

1893. September 2; San José.

Mr. Colton reports that he felt a slight shock of earthquake shortly after 10 p. m., exact time not noted, while in his room at the St. James Hotel.

1893. September 5; Carson City; 11 p. m.

1893. September 6; Redding.

Quite a severe shock of earthquake was felt here at 8.22 o'clock this morning, preceded by rumbling. It lasted several seconds and the vibration was north and south. No damage.

1893. September 7; Las Lunas (N. Mex.).

Central New Mexico has been subject almost daily for more than three months to violent earthquakes. Five commotions Thursday, September 7, threw down a score of old adobe buildings already shaky from previous earthquakes (VII). No lives were lost, but a peculiar feature is that there were numerous cases of nervous sickness, even convulsions, among the inhabitants as soon as the rumbling commenced. The center of the disturbance is Sabinal, where a spring has appeared in a place which always had been dry and barren.

1893. September 28; Mount Hamilton.

Prof. Holden reports the time as 6.20 a. m. Intensity (II), Rossi-Forel scale. Mr. Colton was awakened by the shock and reports "one slight shock," the time being 6.20.10 a. m., Pacific slope time. The Duplex seismograph shows a slight mark of disturbance.

1893. October 15; Santa Cruz; 5 a. m.

A severe shock. The undulations were from west to east.

1893. October 19; Napa (Cal.); 4:20 p. m.

Cal. S. W. Service Bulletin.

1893. November 7; Guadalajara, Mexico.

A severe earthquake has occurred here during the past ten days. The Colima volcano is in violent eruption, and people living at the base of the mountain have left their homes.

At the town of Americus the first severe shock did great damage to property, and several persons were wounded by falling houses (VIII). The disturbance was felt in the States of Oaxaca, Puebla, Guerrero, Morelos, and Jalisco.

1893. November 6; Alaska.

There have been four earthquakes during the summer at St. Augustine Island (Chorna Borna), where the mountain is now emitting dense clouds of smoke. The natives, remembering the devastation caused by the eruption twelve years ago, are deserting the island in haste, abandoning all their interests. The last eruption rendered useless all existing charts of the neighboring waters, causing no fewer than five shipwrecks.

1893. November 21; Capistrano; 7h. 48m. p. m.

A slight shock, which lasted only about two seconds. From the motion of the swinging lamps, the vibrations must have been from west to east.

1893. December 5; Piedras Blancas Lighthouse (S. Luis Obispo Co., Cal.); 8:56 p. m.

Very light shock, lasting about 2 seconds. (Ms. communicated by U. S. Geological Survey.)

1893. December 6; Lewer's Ranch (Nev.); 6 p. m.

Lewer's Ranch (Nev.), 6 p. m.—C. W. F.

1893. December 6; Victoria, B. C.

An active volcano on the American side of the straits was one of the scenes witnessed by the passengers on the steamer Maud, which returned from Alberni to Victoria, B. C., yesterday.

1893. December 11; Carson City; 3:10 p. m.

E. and W. tremor.—C. W. F.

1893. December 12; Lakeport; 3 a. m.

Quite a severe earthquake. The vibration was from west to east. No damage.

1893. December 12; Ukiah; 3h. 15m. a. m.

A sharp shock. The clocks in the public buildings were stopped. Vibrations were from south to north (VI).

1893. December 17; Ontario; 10h. 50m. p. m.

Quite a sharp shock.

1893. December 17; Riverside; 10h. 40m. p. m.

A slight shock. The vibrations, which lasted only a few seconds, were from south to north. No damage.

EARTHQUAKES ON THE PACIFIC COAST, 1894.

1894. January 7; Point Arena Lighthouse; 9:45 p. m.

(IV.)—(Ms. communicated by the U. S. Geological Survey.)

1894. January 14; Olympia, Wash.

Mr. Fred. G. Plummer reports a disturbance at 3.25 a. m. A tremor lasting three seconds was followed after an interval of four seconds by a shock from south-southwest, and a slight tremor later. His seismograph at Tacoma barely showed the shock (I?, II?).

1894. January 14; Vancouver (B. C.).

While the quaking continued, hanging pictures swayed slightly and crockery rattled on the shelves.—*S. F. Chronicle.*

1894. January 17.

[Reports were published that on January 17 Mount Jefferson, as seen from Salem, Oregon, poured forth smoke and steam from its summit at sunrise. Later explanations showed this to be due to atmospheric phenomena.]

1894. January 24; Riverside; 3h. 50m. a. m.

Quite a heavy shock, which lasted several seconds.—*San José Mercury.*

1894. February 5; Keeler, Cal.

A shock of earthquake was felt at 9.01 p. m.—Newspaper.

1894. February 7; San José.

At 2.09 o'clock a. m. there was a slight shock in this city. One short, sharp shock.—*San José Mercury.*

1894. February 8; Los Angeles; 5h. 45m. a. m.

The earthquake shock felt here at 5.45 this morning was also felt quite generally in this section. It was short and sharp, and there was only one shock.—*S. F. Examiner.*

1894. February 15; Hawthorne, Nev.; 9:01 p. m.

(II.)—Report of Nevada State Weather Service, 1894.

1894. March 3; Mount Hamilton.

One shock of intensity III, R. F. 4h. 42m. 50.1s. p. m.—E. S. Holden.

Rattled stoves, etc., slightly in second and third stories of brick dwellings. 4h. 43m. 1s. p. m.—Mr. and Mrs. W. W. Campbell.

Neither of the seismographs showed any record of this shock.

1894. April 15; 20h. 56m.

Ellensburg, Washington, III, duration 10s.—P.

1894. May 7; Mount Hamilton.

Two distinct shocks, two seconds apart, of equal intensity. 11h. 56m. 7s. p. m. for the last shock.—E. E. Barnard.

Four shocks in less than 2 seconds, of intensities III, II, II, III, R. F., respectively. 11h. 56m. 16s. ± 10s. p. m. In bed in the third story of the brick dwelling.—W. W. Campbell. No record of this disturbance was found on either of the seismographs.

1894. Mount Hamilton.

At 10h. 52m. p. m. a movement of the earth was detected by the meridian circle, which was so slight as not to be felt by the observer. The motion was a regular oscillation in an east and west direction, and lasted for fifteen to twenty seconds. At 11h. 56m. 45s. approximately, one single sharp shock was felt.—R. H. Tucker.

1894. May 23; Tacoma, Washington; 22h. 30m.

II.—P.

1894. May 27; Winchester, Cal.; 12 a. m.

Two slight shocks.

1894. June 3; Ukiah (Cal.).

A shock.

1894. June 18; 10 a. m.

Austin, Nevada.—C. W. Friend.

1894. July 13; Pine Ridge, Cal.

News comes from Pine Ridge lumber district, 60 miles northeast of this city, to the effect that a sharp shock, lasting a few seconds, was felt there at 8.50 last night. The shock was accompanied by the greatest electric display ever witnessed by inhabitants there. The strange feature is that no clouds were noticed by the citizens.—*S. F. Call.*

Parties arriving from Pine Ridge, 50 miles east of here, state that a recent earthquake [July 13?] injured the dam across Stephenson Creek. The joints in the masonry were damaged sufficiently to allow the water to pass through, but it is believed that no permanent injury was done.—*S. F. Chronicle.*

1894. July 14; near Fresno.

A remarkable phenomenon is reported from the Sierra Nevada Mountains east of Fresno. About sunset last evening a red cloud, apparently fifty miles in length, gradually settled over the range, and as soon as night came on persons in this city observed a wonderful display of electricity on the edges of the cloud.

To-day news from that region says that when the electrical display was at its height an earthquake, violent enough to rattle

houses and shake trees, was felt (VI). It continued several seconds. After it had subsided the cloud rapidly passed away and the atmosphere became clear.

So far as can be learned the earthquake was felt at no place else than immediately under the cloud. It was not felt on the plains, 20 miles distant.—*S. F. Chronicle.*

1894. July 18; Ogden, Utah.

At 3.50 p. m. distinct earthquake shocks were felt. Dishes were shaken from the tables, the walls of some large blocks were cracked, and a general shaking up occurred (VIII?). Many people were frightened into leaving their houses.—*S. F. Chronicle.*

1894. July 29; San Bernardino.

A shock of earthquake occurred at about 9.15 p. m. The movement was of several seconds' duration, and seemed to be from the northwest to the southeast. The disturbance was very noticeable, causing doors and windows to rattle, chandeliers to swing, and buildings to vibrate (VI). No one was injured and no property destroyed.

The First Methodist Episcopal Church was occupied at the time the earthquake occurred. The building is large and built of brick, and the disturbance caused a panic that was soon quelled, though a number sought safety in the open air (VI). The pastor continued his discourse as soon as quiet was restored.

In the yard at the depot cars standing on the track were put in motion and the men had to set the brakes.

Some report seeing a large meteor at the same time the shock occurred. The clock in the old court-house tower stopped at 9.21 p. m. (VI?).—Newspaper report.

1894. July 29; Arlington (Cal.); 9 p. m.

Two shocks, the first light, the second severe.

Los Angeles: at 9.12 p. m. the city was shaken by an earthquake, which was one of the most severe felt for many years. The undulations appeared to be from south to north, and there were three distinct tremors. The first was a light one, but the second made the windows rattle and disturbed loose articles lying about on mantels and shelves (VII?). With the third tremor the wave passed. As far as could be learned no damage was done, aside from the breaking of a few panes of glass (VI?). The shocks created consternation in some of the hotels, and caused the inmates to start out in more or less confusion. The tower of the City Hall swayed very perceptibly, and the electric-light masts continued to vibrate for fifteen or twenty minutes after the disturbance.

In the stores along Spring and Main streets the chandeliers swung like clock pendulums and the glassware and crockery

rattled at a lively rate. In some places the guests rushed out, leaving their meals uneaten, but soon recovered from the scare and returned. At the post-office, in the Federal Building, which is one of the most solidly constructed edifices in the city, the shock was very severe, and caused a panic. The only damage done, however, was the breaking of several bottles of ink, which were jarred off the shelves (VI?).

Pasadena: a severe shock was felt here at 9.17 p. m., lasting ten seconds. The motion was from northwest to southeast, and the shock was accompanied by a loud rumbling. It was felt all over the city, brick buildings being shaken until the bricks creaked. There was much excitement in the churches and meetings. No damage was done in the city so far as known. At Echo Mountain the new hotel was shaken.

Santa Monica: two distinct shocks were felt about 9.11 p. m., the last shock being the heaviest ever felt here. The plate-glass windows in the Hotel Jackson were distinctly seen to wave in and out. No damage (V?, VI?).

Santa Ana: at 9.15 o'clock this evening this city was visited by the heaviest earthquake ever experienced here. Buildings shook and glassware and crockery rattled (V?, VI?). There were three shocks, the vibration being from south to north. The electric-light masts continued to vibrate for some minutes after the shock.

Mojave: a heavy shock of earthquake at 9.12 o'clock this evening shook this town badly. Goods were knocked off the counters of stores and general excitement prevailed. The vibration was from north to south (VII?).

Ontario, Cal.: the severest earthquake shock ever felt here occurred at 9.12 p. m. No damage.—*Los Angeles Times.* This shock felt at Chino (9.15 p. m., "sharp shock"); Fallbrook (9 p. m., "slight," S. W. to N. E.); Tremontville (9 p. m., three shocks); Ventura 9.15 p. m.).

1894. August 3; Mount Hamilton.

Professor Holden reports a single shock of intensity III to IV on the Rossi-Forel scale as awakening him at 11h. 50m. p. m. ± one-half minute. He was expecting an alarm clock to go off, and presumably was easily awakened. The duplex seismograph gave a record of this shock, the displacement of the earth being 0.25 mm. in an east and west direction.

1894. August 3; Hydesville; 9:30 p. m.

"Slight."—Cal. S. W. Service *Bulletin.*

1894. August 22; Lewers Ranch, Nevada; 4:28 a. m.

II.—Report of Nevada State Weather Service, 1894.

1894. September 30; Mount Hamilton.

The record of a single vibration was found on the duplex seismograph on the morning of October 1. The seismographs were examined on the evening of September 30 and again on the morning of October 1, when the record was noticed, so that the shock must have occurred in this interval, although it was not felt by any one here and did not start the Ewing instrument. The displacement of the earth was about 0.25 mm.

Eureka: Two heavy earthquake shocks occurred here this morning, the first at 9.36 o'clock, lasting nearly half a minute. The vibrations were from north to south. The second was at 9.59 o'clock, the vibrations being from northeast to southeast. It lasted five seconds. No damage.

Sisson: A slight earthquake shock was felt in this vicinity this morning. The vibrations were from north to south.—*S. F. Chronicle.*

Hydesville: 9.37 a. m., quite heavy, 10.22 a. m., very light.

1894. September 30; Edmanton (Cal.); 9:30 a. m.

A slight shock.

1894. October 17; Pasadena; 3:05 p. m. local time.

A severe triple shock.

1894. October 23; San Diego (6:03 p. m. ?).

Two very heavy shocks. Clocks stopped, etc. (VI). A third shock at 7.25 p. m. Very light.

1894. October 23; San Diego.

This city and neighboring towns were visited this afternoon by a series of earthquakes of more than ordinary severity. The first shock occurred at (3.03 p. m.?) and was followed at intervals of a quarter of a minute by two others, the last being one of the strongest experienced hereabouts since the advent of Americans. People in brick houses swarmed into the streets, hearing the grinding of brick and mortar and seeing in some cases the walls crack (VII?, VIII?). A loud noise was heard in all parts of the city immediately preceding the shock. Considerable consternation was caused in the public schools.

The second shock was observed by few people, being very light, but the third was so pronounced as to bring the people into the streets without delay (VII?). Messages from Coronado, Upper Otay Dam, Campo, National City and other places show that the earthquake was felt about equally at all surrounding points. Loose rocks were shaken from the hillsides and rattled down the canyons, and a heavy booming noise accompanied the tremors. The weather observer reported another slight shock at about 4.25 o'clock, not so strong as the first ones, but quite perceptible. It

was not felt on the ground. The waves were from east to west in all instances. No serious damage was done.

Riverside: two distinct shocks of earthquake occurred at 3 p. m. The first was light, followed in a few seconds by quite a sharp shake. No damage.

San Bernardino: two distinct shocks were felt here at 2.04 p. m. The vibrations lasted twenty seconds and the motion was from west to east.

Colton: a light shock was distinctly felt here about 3 p. m.—*S. F. Examiner.*

Los Angeles: a slight shock was felt here at 3.05.—*San José Mercury.*

1894. October 27; Los Angeles.

A slight shock occurred here to-night at about 11 o'clock. No damage.

San Diego: a shock of 10 seconds' duration was felt here at 11.05 to-night. It caused some excitement, but no damage is reported. —*S. F. Chronicle.*

1894. November 2; Mexico City.

Two violent earthquake shocks occurred at 4.17 p. m., with four minutes' intermission. During the vibrations the earth seemed rocking like a ship at sea and the natives were on their knees in the streets praying frantically.—*S. F. Bulletin.*

1894. October 23; Julian (Cal.).

A sharp shock, 3 p. m.

1894. October 24; Berkeley (Cal.).

Slight record.—Professor Soulé.

1894. October 24; Claremont (Cal.).

Two shocks, 3h. 4m. 40s. p. m.

1894. November 10; Carson (Nev.); 6:55 p. m.

E. W., light.—C. W. F.

1894. November 14; Gold Hill, Nev.; 2h. 2m. (p. m.?).

An earthquake. There were two shocks, with an interval of a minute between them. Most of the people thought the disturbances were caused by blasts in the mines. At 6.58 o'clock this evening a shock occurred that brought the occupants of many buildings into the streets (VII). It was of short duration, but rattled windows and glassware at a lively rate. The vibrations appeared to be from southeast to northwest.—*S. F. Chronicle.*

Carson, Nev.: 6.55 a. m. (I).

Lewers Ranch, Nevada: 7.05 p. m. (I).—Report of Nevada State Weather Service, 1894.

1894. November 14-18; Nevada.

The following table was sent to the U. S. Weather Bureau by F. A. Carpenter, observer at Carson City. The times are all 75th meridian times. [I have added the last column.—E. S. H.]

Date.	Carson City.		Virginia City.		Difference in Time.
	Time.	Direction.	Time.	Direction.	
Nov. 14	9.55 A. M.	....	....	....	....
" 16	2.07 A. M.	....	2.00 A. M.	....	+ 7 m.
" 16	2.25 A. M.	E. & W.	2.18 A. M.	E. & W.	+ 7 m.
" 16	3.00 A. M.	E. & W.	2.52 A. M.	....	+ 8 m.
" 18	5.38 A. M.	....	5.28 A. M.	....	+ 10 m.
" 18	5.40 A. M.	....	5.30 A. M.	....	+ 10 m.
" 18	5.49 A. M.	E. & W. (light)	5.40 A. M.	N. & S. (severe)*	+ 9 m.
" 18	8.15 A. M.	....	8.00 A. M.	....	+ 15 m.
" 18	8.33 A. M.	....	8.24 A. M.	....	+ 9 m.
" 18	9.22 A. M.	....	9.18 A. M.	....	+ 4 m.

* Walls cracked; window glass broken (VII).

1894. November 15; Carson, Nev.

Three heavy earthquake shocks were felt here. The first and heaviest was at 11.05 p. m., the second at 11.25 p. m., and the third at 12. The direction was east and west. Though the shocks caused fright, no damage was done.—*S. F. Chronicle.* [11.07 p. m., 11.25 p. m., 12.00 p. m., all " light."—C. W. F.]

Gold Hill, Nev.: three tremors of intensity II. (No time given.)

Lewers Ranch: at midnight three tremors of intensity III; felt by persons all over Washoe Valley.

Virginia, Nev.: 11 a. m. (II); 11.18 p. m. (II); 11.52 p. m. (II).—Report of Nevada State Weather Service, 1894.

1894. November 16-22; Virginia, Nev.

There have been, according to different calculations, over one hundred shocks of earthquake in this city within the week. The greater number of vibrations have come from west to east. Nevada has been almost free from earthquakes since the advent of the white man. There are no Indian traditions in reference to former earthquakes in any portion of Nevada as far as can be ascertained from the most intelligent of the Indian residents here.—*S. F. Examiner.*

1894. November 17; Campo; 5h. (p. m.?).

A heavy shock lasting several seconds. The oscillation seemed to be from northeast to southwest.—*S. F. Chronicle.*

1894. November 18; Carson, Nev.

Earthquake shocks continue to be felt. Between 3 and 7 o'clock this morning six distinct shocks were felt, the first being very heavy. Thus far no damage has been done except to cause acute nausea (VII) and prevent sleep. The direction of the vibrations

varies considerably, and the shocks are usually preceded by a roaring sound.—*S. F. Chronicle.* [2.38 a. m.; 2.40 a. m.; 2.49 a. m. (III, sharp); 5.15 a. m.; 5.33 a. m.; 7.22 a. m.; all "tremors" except 2.49 a. m.—C. W. F.]

Austin, Nev.: 10 a. m. (II); Carson, 2.38 a. m. (I); 2.40 a. m. (I); 2.49 a. m. (III); 5.15 a. m. (I); 5.33 a. m. (I); 6.22 a. m. (I).

Gold Hill, Nev.: four tremors of intensity II. (No time given.)

Lewers Ranch, Nevada: (no time given.) (I.)

Virginia, Nev.: 2.28 a. m. (II); 2.30 a. m. (I); 2.40 a. m. (IV) (this shock cracked plastering; in some places walls were damaged; in many instances window glass was broken (VI?, VII?)); 5 a. m. (II); 5.24 a. m. (I); 6.18 a. m. (II).—Report of Nevada State Weather Service, 1894.

1894. November 19; Julian (Cal.); 10:20 a. m.

A shock, followed by lighter ones for several days.

1894. November 21; Mount Rainier (Tacoma).

F. L. Lowe, a carpenter, says he and some companions were within 6 miles of Mount Tacoma's top, November 21, and that several shocks of earthquake were distinctly felt at the mountain's base. Several great avalanches were heard crashing down the mountain side on the north of the mountain. Rocks were piled over 100 feet high in the Puyallup River. Returning they crossed the débris of an avalanche which was of great depth, half a mile wide and 4 or 5 miles long.—*San José Mercury.*

1894. November 21; Tacoma, Wash.; 6h. 30m. p. m.

Several slight shocks. Windows were rattled throughout the city. The first shock was most severe, being accompanied by rumbling noises, as of a distant explosion, and simultaneously a sheet of flame was observed in the eastern heavens.

Carson, Nev., in night (I).—*Report* of Nevada State Weather Service, 1894.

1894. Mount Rainier, Washington.

Mount Rainier, Washington; much has been said in the newspapers concerning an appearance of change in the summit of this mountain. The principal facts seem to indicate some sort of change, possibly due to avalanches, and the report that smoke issued from the crater seems worthy of credence. On the morning of November 21 five citizens of Seattle report that they saw puffs off smoke coming from the west side of the top of the mountain at intervals of twenty seconds from 6.20 to 8 a. m. The smoke came up in huge, balloon-shaped masses, and after hanging suspended for a short time was wafted toward the eastern side of the mountain. Before 8 o'clock the top of the mountain had lost its whiteness, and appeared dark, jagged and rough. The same phenomena were observed from Tacoma and Portland. On the

afternoon of Thursday, December 13, smoke was seen rising from the crater by Observer Saulsbury, of the Weather Bureau, and others, from Seattle. Mr. Saulsbury saw the phenomenon through a glass repeatedly from 9 a. m. to 1 p. m., and was positive that the substance was smoke and not vapor.

The Seattle *Post-Intelligencer* sent out an exploring party in the latter part of December to reach the summit if possible and determine the character of the phenomena. This party, owing to the dangerous condition of the snow fields, could get no farther than the foot of Carbon Glacier, from where the following message was sent back by homing pigeon on December 26:

"The expedition has been an entire success. It has demonstrated that while the mountain has been smoking and steaming, the change is due principally to tremendous avalanches and not to an eruption. The new peak observed from Seattle is off Columbus crest, and was formed by spiral winds carrying snow and whipping it into the cone-shaped peak described."—*San José Mercury.*

The Seattle *Post-Intelligencer* of January 6, 1895, contains a full report of the expedition. Without being able to reach the summit, the explorers report having seen, on December 24, jets of steam issuing from the large crater and a column of black smoke from the small crater.

Of interest in this connection is the following report from Ellensburg:

"The eruption of Mount Rainier has explained a mystery that has baffled all. The waterworks reservoir here suddenly became exhausted. Investigation showed a crevice running along the hill north and south, varying from 1 inch to 1 foot in width and of unknown depth. It ran directly through the reservoir, letting the water out. It has been traced several hundred feet along the hill. No shocks of earthquake have been felt here as far as known."—*S. F. Chronicle.*

(Ellensburg is over 200 miles distant from Mount Rainier.—C. D. P.)

1894. November 24; Carson, Nev.; 10:03 p. m. (II); 11:22 p. m. (III).
(Sharp.)—Report of Nevada State Weather Service, 1894.

1894. December 4; Carson, Nev.; 9:39 p. m. (I); Lewers Ranch; 9:40 p. m. (II).
Report of Nevada State Weather Service, 1894.

1894. December 18; Carson, Nev.; 9:09 p. m. (II).
(C. W. F.)—Report of Nevada State Weather Service, 1894.

1894. December 21; Gold Hill, Nev.; 2:20 a. m. (II).
Report of Nevada State Weather Service, 1894.

1894. December 23; Los Angeles.

Earthquake shocks were experienced this morning at San Diego, Riverside, Pomona and other points. No damage was done.—*San José Mercury.*

1894. December 24; Boise, Idaho.

Boise was visited by three slight earthquake shocks this morning. The first was very slight, about 4 o'clock; the second light, about 6 o'clock. The third shock was felt everywhere in the city, and came at 7.10 o'clock. Houses vibrated perceptibly and people were awakened (VI). The shock was accompanied by a booming sound like the roar of a gale of wind.—*S. F. Chronicle.*

1894. December 28; Gold Hill, Nev.; 9:15 a. m. (I).

Report of Nevada State Weather Service, 1894.

1894. December 29; Gold Hill, Nev.; 4:30 a. m. (II). 5 p. m. (I).

Report of Nevada State Weather Service, 1894.

1894. December 30; City of Mexico.

At 10.53 o'clock on Sunday (December 30), an oscillatory earthquake shock was felt in this city and other parts of the valley of Mexico. The movement was east and north, but of short duration. The disturbance caused great alarm among those who feared a repetition of the disastrous earthquakes of November 2, which killed 18 people and did great property damage. In the Arben Theater, the only playhouse now open in this capital as a result of the damage sustained by other theaters in previous shocks, a stampede occurred (VII?).

The scene of November 2 was repeated in a large part, and thousands of penitents knelt in the open streets and prayed and cried in a loud voice for deliverance from death.

Large supply pipes leading to the city burst, flooding the streets.

The shock last night lasted nine seconds. It is known that three persons were seriously injured. A number of buildings were destroyed (VIII?).—*S. F. Call*, January 2, 1895.

EARTHQUAKES ON THE PACIFIC COAST, 1895.[1]

1895. January 5; Mount Hamilton; 3h. 4m. 57s.$\pm$a. m.

One light shock.—A. L. C. The duplex seismograph registered a disturbance principally northeast and southwest (one wave), the displacement of the earth being 0.5 mm. There was a series of vibrations at right angles to this of about ¼ mm.

[1] This list contains several occurrences the correctness of which may well be doubted. These cases rest upon newspaper report entirely and are of such a nature that there should be confirmatory evidence before accepting them. It has been thought best to include these doubtful cases, however, and they are indicated by some note after them.

1895. January 7; Lewer's Ranch (Nev.); 11 a. m.

—C. W. F.

1895. January 15; Gold Hill; 6 a. m.

—C. W. F.

1895. January 23; Ukiah.

A heavy shock of earthquake was felt in this city this morning. After the shock the sky cleared and the rain ceased.—*San José Mercury*, January 23, 1895.

1895. January 25; Lewer's Ranch (Nev.); 4 a. m.

—C. W. F.

1895. January 26; Helena, Mont.

An earthquake shock was felt here at 5 o'clock this morning. Small articles were shaken off the shelves.—Newspaper report.

1895. February 25; Portland, Oreg.; 4:47 a. m., standard time.

Three slight shocks from northward. Intensity III.

Tacoma, Wash., and points to the southward: same time. Three slight shocks from S. 10° W., intensity III; Green River Mines, intensity V. My "home-made" seismograph only records horizontal shocks and showed only $\frac{1}{20}$ inch. The directions noted would place center near Toutle River, where I observed a vertical shock—already reported (1893).—F. G. Plummer, Tacoma, Wash.

Portland, Oreg.: three distinct shocks of earthquake were felt here early this morning. Each shock lasted about three seconds. The first occurred at 4.47. The vibrations were from north to south. —*San José Mercury*, February 26, 1895.

Tacoma, Wash.: this morning's earthquake shock was plainly felt in Tacoma, on top of the hill, and at Edison, at Sumner, Puyallup, and Steilacoom. There were three light vibrations occurring just before 5 o'clock, the general trend being from north to south, though at Steilacoom the vibrations seemed to be from east to west.—*San José Mercury*, February 26, 1895.

1895. February 28; Independence (Cal.); 12:25 a. m., 120th meridian time.

Duration 20 sec. The shock was preceded by unusual noise. A second shock about 2 minutes after the first. Light objects overturned, tables moved, etc. (VII). The shock was felt from Bishop's Creek to Keeler.

1895. March 1; Ayatlan, Mexico.

Inhabitants of Southwestern Mexico are alarmed over the frequent earthquake shocks which have occurred during the last month, although little damage has been done. Shocks are accompanied

by subterranean rumblings, followed by a discharge as from an artillery, which shakes the earth for nearly half a minute at a time. The recent outbreak of the subocean volcano off the Pacific coast, in Guerrero, is ascribed as the reason for the frightful demonstrations.—*S. F. Examiner*, March 2, 1895.

1895. March 1; at sea, off the Mendocino (Cal.) coast; longitude 125° 20′, latitude 40°.

The recent earthquake which was reported as having disturbed the inhabitants of Mendocino proved to be a veritable terror at sea, according to the stories told by the crews of the schooners Volant and C. T. Hill, which have just arrived from that section of the coast.

The Volant was about 52 miles off the Mendocino coast, in the vicinity of Shelter Cove, when she encountered the shake-up. It took place a few minutes before 1 o'clock on the morning of March 1. The sea had been quite calm all night, but the breeze kept up well. The first warning of the earthquake came in the form of a deafening roar which seemed to rise out of the sea. In an instant the ocean was lashed into a mass of foam, and in spots it rose in great geyser-like columns. The schooner stopped with a crash and then shook for fully two minutes. Every timber and bolt groaned and creaked, and it was thought for a moment that she was going down. Those on deck were knocked down. The schooner pounded up and down frightfully for a few minutes, just as if she were aground, and then all became still. We had scarcely recovered our senses when a second shock came, but it was not nearly so severe as the first. When this one was over the sea became as still as a mill pond, the wind died out, and everything was as quiet as death. The schooner C. T. Hill, which was carrying lumber, was also tossed about by the temblor. She was only a few miles astern of the Volant at the time. Captain Forest's story of the experience is similar to that told by the crew of the Volant.—*S. F. Chronicle.*

NOTE.—Inquiries addressed to the captains of the vessels named, through the Merchants' Exchange of San Francisco, elicited no reply.—C. D. P.

The following paragraph by Dr. Edward S. Holden, from the *Publications of the Astronomical Society of the Pacific*, Vol. VII, 1895, page 131, is of interest:

"The *S. F. Chronicle* of March 8, 1895, gives an account of a severe earthquake shock experienced by two vessels some 50 miles off Cape Mendocino, in longitude 125° 20′, latitude 40° (both approximate). My List of Recorded Earthquakes in California (1887) contains several notices of shocks felt in this vicinity, as follows:

"'At sea, 45 miles W. S. W. of Cape Mendocino;

"'At sea, 50 miles W. S. W. from Cape Mendocino;

"'At sea, longitude 126° 25′, latitude 41° 55′;

"'At sea, longitude 125° 50′, latitude 40° 24′;

"'At sea, longitude 125° 20′, latitude 40°—(as above).'

"A relief map of the ocean bed near Cape Mendocino, made by Prof. George Davidson and Mr. Winston, shows the coast to be very 'steep-to'; and it further shows two submarine mountains in the neighborhood.[1] The slipping of the earth at the junction of the steep submarine cliff with the (comparatively) flat ocean floor may very well be the cause of some of these disturbances. It is also possible, at least, that they are connected with the two submarine elevations mentioned. More observations are needed to decide this question. It is a little remarkable that we have reports of shocks felt at sea in this vicinity and none, or few, at other points along the coast." (See Oct. 24, 1895.)

1895. March 10; San Miguel Island.

This is one of a chain of islands about 30 miles off the coast, near Santa Barbara, Cal. On March 17 newspapers published reports of a disturbance on this island about March 8, by which the shore in places was elevated 60 feet and other considerable changes wrought. Another disturbance is reported about March 30, by which a small schooner was wrecked in the harbor at the island. A third disturbance was reported in July on Flea Island, an islet in the immediate neighborhood. Through the kindness of Mr. J. J. Hollister, of Santa Barbara, we learn that there was a large landslide on San Miguel Island. This fact was worked up by a newspaper reporter into a very sensational article.

Cordoba, Mexico: the peak of Orizaba is reported in press dispatches to be in a state of eruption after many centuries of quiescence.

1895. March 12; Mount Hamilton; 9h. 34m. 17s. p. m., Pacific standard time.

One short, sharp, vertical shock. Rossi-Forel (V).—E. S. H. At 9h. 34m. 17s. p. m., Pacific standard time (in sitting room on Mt. Ptolemy), strong vertical shock, followed by two very quick weak shocks. All three lasted less than 1s. Absolutely no horizontal component noted. Intensity of first shock IV or V.—W. W. C. 9h. 34m. 17s. p. m., Pacific standard. One sharp shock followed by one or two slight tremors. Doors and other objects rattled in third story of brick dwelling. Rossi-Forel V.—C. D. P. The duplex seismograph recorded several small vibrations without any decided tendency as to direction; the displacement of the earth being about 3/8 mm.

1895. April 1; Eureka; 8h. 42m. a. m.

A sharp shock. The vibrations were from southwest to northeast. —Newspaper report.

[1] This map is reproduced in the present volume.

1895. April 6; San José.

The *Evening News* reported a shock "just before 7 a. m." The correspondent of the *S. F. Chronicle* reported a shock about 6.45 a. m. Not felt at Lick Observatory.

1895. April 16; Port Townsend, Wash.

Two slight shocks were felt here shortly after midnight last night. Heavy brick buildings trembled and many people were frightened badly.—*S. F. Examiner*, April 17, 1895 (VI?).

1895. April 17; Vacaville.

Quite a sharp earthquake shock was felt here this morning about 12.30 o'clock.

Virginia, Nev.: there was a short, sharp shock at 6 o'clock this evening.—*S. F. Chronicle*, April 18, 1895.

1895. April 18; Ukiah.

A small unnamed island off the coast of this county (Mendocino), opposite Bournes Landing, is now in a state of eruption, according to the report of an observer. For some time past it has been reported that flames were issuing from the center of the isle. J. E. Meredith, who has been traveling along the northern coast for some weeks, passed the island Thursday. It was some time during the early evening, and he was attracted by a bright light in the west. The flames were so brilliant that he at first imagined they were caused by a burning ship at sea. On his return south the next day, however, he discovered smoke curling up and then saw it emanated from a peak on the island.—*San José Mercury*, April 22, 1895.

NOTE.—This has not been verified.—C. D. P. Forest fire?—E. S. H.

1895. April 19; Victoria, B. C.

A slight shock of earthquake, moving from east to west, was felt here a little before midnight. Buildings all through the city trembled and all the telephone calls came down together with a clatter.—Newspaper report.

1895. April 27; City of Mexico, Mexico.

Colima volcano is again in a state of eruption, emitting great columns of smoke and fire both night and day. The inhabitants of the immediate neighborhood of the volcano are leaving their homes.—Newspaper report.

1895. May 1; Lakeport; 2h. 30m. a. m.

Quite a severe shock. The vibrations were from west to east and lasted from five to seven seconds. No damage.

1895. Ukiah; 3h. a. m.

A severe shock, lasted some seconds.—Newspaper report.

1895. May 21; San José-Mount Hamilton.

[The telephone operator in San José reported a shock of earthquake in San José about 10.45 a. m. W. W. C. and R. H. T. (at Mount Hamilton) noticed *rattling* about that time, but felt nothing. The duplex instrument shows a slight mark, probably from this shock, of 1 mm. (earth's movement ¼ mm).—N. W. Later it was learned that the nitroglycerin works at Pinole, Contra Costa County, had exploded at 10.40 on that morning. Doubtless the shock noted above was due to this explosion. Pinole is nearly 60 miles in an air line from Mount Hamilton.]

1895. May 24; Berkeley.

Slight record.—Professor Soulé.

1895. June 4; Berkeley.

Slight record.—Professor Soulé.

1895. June 4; San Francisco.

[A blast of 15,000 pounds of powder was exploded on Clarendon Heights. No effect was noticed at Mount Hamilton.]

1895. June 10; Berkeley.

Slight record.—Professor Soulé.

1895. June 11.

[A newspaper account from New Whatcom, Wash., says Mount Baker (40 miles away) has been smoking or steaming, and that a new peak has appeared between the dome and south peak, visible at New Whatcom with the naked eye. Note.—This report has not been verified.—C. D. P.]

1895. June 15; Port Townsend, Wash., June 16.

[Chimacum, a small farming center 4 miles from here, was terribly shaken last night at 8 o'clock by the falling of a huge meteor, which burst with a loud noise, and after causing a small-sized cyclone of several minutes' duration, buried itself deep in the muddy bottom of a neighboring lagoon. The meteor struck with force enough to break crockery in farmhouses 3 miles away and created great terror among the residents. Ten hours after the occurrence the waters of the lagoon were still bubbling and seething, and were found to be hot. Systematic dragging of the lagoon failed to bring up any traces of the celestial messenger.—*S. F. Examiner*, June 17, 1895.]

1895. June 20; Mount Hamilton; 9h. 43m. 26s. p. m. Pacific standard time.

"One shock of intensity II or III, northeast and southwest, third-story brick house."—C. D. P. The duplex instrument shows a single displacement of the earth of about ½ mm. in a northeast and southwest direction with several very small vibrations at the end.

"About forty-five minutes after the first earthquake shock a star viewed in the 12-inch equatorial was seen to vibrate sharply over an arc of 1″ or 2″. The telescope was clamped at the time. If this was a second earthquake shock it was too slight to be felt." —R. G. A.

Smith Creek: a lady visitor reported that the earthquake of June 20 was felt at Smith Creek, foot of Mt. Hamilton.

1895. June 16; Cocopah Mountains.

George Neal, a mining man, saw a sight on the desert last Sunday that filled him with amazement. He was in company with Lew Hosgate at the time. Their property is on the Tajo River. At that place the desert is in plain view for miles. Neal looked across toward the Cocopah Mountains, and was surprised to see a heavy column of smoke ascending from the central peak of the three Pichacos that rose several hundred feet. Neal and Hosgate watched the black column, and saw it shoot high into the air at intervals, and a distant booming sound was heard as of cannonading. The Indians told them that the Cocopah country was on one of its "tantrums" again, and that the mud volcanoes, gas fissures, hot springs and fire volcanoes were all at work with more activity than ever before. Many Cocopah and Santa Catarina Indians were reported to have fled from the mountains into the interior of the peninsula and over to the Colorado River. Gas wells or fissures exist, according to the Indians, which blow at irregular intervals, emitting a whistle which can be heard for miles.—Newspaper report. Note.—This has not been verified.—C. D. P.

1895. June 24; Mount Hamilton; 9h. 25m. 36s. ± 2s., standard Pacific time.

"One earthquake shock at the above time. I was observing with the 36-inch. Planet moved north and south over about 5″ or 6″." —E. E. B.

"A slight earthquake shock was noticed at 9h. 25m. 41s., Pacific standard. The 12-inch equatorial telescope was directed at ν Scorpii at the time, and stars A and B were seen to vibrate three or four times over an arc of nearly 4″ north and south in the field of view, coming back nearly to their original position."—R. G. A. The duplex seismograph shows a single displacement of the earth of about ⅕ mm. about north-northeast and south-southwest.

1895. June 28; Seattle; Wash.

Assistant Weather Observer E. O. Hobbs has recently been making some examinations on the summit of Mount Rainier with a small telescope and has discovered a large dark crevasse through the center of Columbia Crest, which can be seen plainly with the naked eye. A large snowslide has recently occurred at the base

of Liberty Cap on the north side, and on the west side there appear to be several new crevasses of various sizes. Mr. Hobbs has also noticed the mountain steaming and smoking in the same manner as last winter.—*S. F. Chronicle*, June 29. Note.—This report has not been confirmed.—C. D. P.

1895. July; Nanaimo, B. C., via Vancouver, B. C., July 9.

The earthquake shock at Nanaimo this week caused no little alarm in that city. The alarm was, however, soon dissipated, and the shock, which lasted a few seconds only, did no damage except the breakage of some crockery in houses and stores (VII).

There are persistent reports by dwellers in the neighborhood of Hope, a small town about 100 miles up the Fraser River, to the effect that one of the small mountains in the Smimilkameen is an active volcano. Flames are seen shooting therefrom at night, and several parties have lately attempted, in consequence, to explore the vicinity.—Newspaper report.

1895. July 26; Santa Barbara; 4:10 p. m.

Earthquake lasted three seconds. Vibration northwest to southeast.—*S. F. Chronicle*, July 27.

1895. August 4; Gilroy; 2 a. m.

A shock. The vibration was from west to east, and lasted but a second. No damage.—*S. F. Call.*

1895. August 15-17; Virginia, Nev.

Six shocks, two of which were quite severe, during the past two days.—Newspaper report.

1895. September 1; Tacoma, Wash.

The mountain-climbers who returned to-night from Mount Tacoma report steam, smoke and gas belching from the foot of Nisqually Glacier, where the Nisqually River has its source.

At the rim of the crater, southeast of Columbia Crest, the ground is quite warm, notwithstanding the arctic atmosphere of the summit. Steam comes out of the crater at this particular point more freely than any other part.—*San José Mercury*, September 2, 1895.

1895. October 7; Mills College; 7:17 p. m.

" With this I send a blue print of an earthquake tracing, the first I have observed for some time. The shock occurred about 7h. 17m. p. m., October 7, 1895, and was distinctly felt, though it was not severe. There was a slight premonitory rumbling, then a distinct shaking."—Josiah Keep. The tracing inclosed with the above is somewhat indistinct, and the limits of vibration consequently uncertain, but seems to be about 10 mm. by 1½ mm., the longer direction being about north-northwest by south-southeast. The disturbance seemed to be composed of several nearly parallel waves.

Albuquerque, N. Mex.: the people of Sabinal and Jorales, two small settlements south of this city, are greatly excited over three distinct earthquake shocks, and many have moved from their homes into the mountains. The waves were from the southeast to the northwest and were so strong that houses rocked to and fro and household goods tumbled from the shelves (VII?). The shocks were felt here last night, but only slightly.—*S. F. Examiner*, October 8, 1895.

1895. October 14.

The tide-gauge of the U. S. Coast Survey at Sausalito shows evidences of a heavy storm or earthquake. The irregularities in the record began at 8.20 a. m. on October 14 and lasted continuously for eighteen hours.—*S. F. Call*, October 19, 1895.

1895. October 20; Olympic Mountains, Washington.

[This range was reported in active eruption about this time, but upon investigation it was found that the flames seen were those of forest fires and from a burning vein of lignite coal.]

1895. October 24; at sea, off the California coast.

The ship John C. Potter, Captain Meyer, makes the following report to the Merchants' Exchange:

"October 24, in latitude 43° 54′ north and longitude 128° 32′ west, experienced a severe shock of earthquake, lasting 25 seconds. It made the ship shake as if it had jumped over a coral reef in a heavy swell."—*S. F. Chronicle*, October 31, 1895.

1895. November 7; Mount Hamilton; 5h. 46m. 34s. a. m.

"Slight shock. 3h. 12m. 55s. p. m., two severe vibrations a second or two apart; direction of motion seemed to be *downward* and toward the northeast."—A. L. C.

"3h. 12m. 51½s. p. m., Pacific standard time. In southeast corner room, first story, brick house. Heavy shock lasting four or five seconds; R. F. (V). One or two light trembles and then two heavy waves, the principal direction *felt* being about southwest and northeast. Motion appeared to be almost entirely horizontal; could not distinguish any decided vertical motion. Some article in the dark room fell to the floor after the heaviest shocks. Disturbance ended rather abruptly. Wind light, from northeast. Hazy. No noise noticed before the shock. A small notch in barograph record at this time. Barometer unsteady, but this notch seems as if it might be due to the earthquake." Notch is 0.01 or 0.02 of an inch in depth.—C. D. P. The Ewing instrument was not started, but the pens show a vibration as follows:

East and west,	4.0 mm. = 1.2 mm. displacement of earth,
North and south,	3.7 mm. = 1.1 mm. displacement of earth,
Vertical movement,	10.5 mm. = 6.6 mm. displacement of earth,

which, however, is very uncertain and is undoubtedly very much augmented by the "creep" of this pen due to temperature, which is large. The clock was started, giving the time as 3h. 12.7m. p. m.

The duplex seismograph shows a complicated series of motions, of which the greatest were east-southeast and west-northwest 7 mm., or 1¾ mm. actual displacement of the earth. The greatest displacement of the earth at right angles to this direction was ¾ mm.

San José: the city was visited by a sharp shock of earthquake at 3.14 o'clock this afternoon, lasting ten seconds, the vibrations apparently being from east to west.—*S. F. Examiner*, November 8, 1895.

Santa Cruz: an earthquake, the heaviest in five years, was felt here at 3.15 o'clock this afternoon. The vibrations were from east to west.—*S. F. Examiner*, November 8, 1895.

San José: San José was visited by an earthquake about 3.15 o'clock yesterday afternoon. There were two sharp shocks of short duration. No damage.—*San José Mercury*, November 8, 1895.

1895. November 26; Mount Hamilton.

"A light shock was felt to-day at 1h. 56m. 35s., Pacific standard time. Its direction could not be noted. (II? E. S. H.) Its duration was but momentary. I should estimate its intensity on the Rossi-Forel scale as III."—R. G. A.

1h. 56m. 35s. p. m., Pacific standard. Light shock. Rossi-Forel II.—C. D. P. Did not start the Ewing instrument. The east-and-west pen shows a vibration of the earth of about 0.5 mm., and the north-and-south pen a vibration of about 0.4 mm. The vertical motion is masked entirely by the "creep" due to temperature. The duplex instrument shows one (only) complete wave, about northeast and southwest, with a displacement of the earth of 0.4 mm.

1895. November; Kyuquot, B. C.

Via Victoria, British Columbia, November 30. Kyuquot, an Indian village on the west coast of Vancouver Island, received a severe shock of earthquake early this month which the natives will long remember. Their little houses were shaken almost from their foundations, trees swayed, and considerable damage was done (VI).—*S. F. Call*, December 1, 1895.

1895. December 8; Fairfield.

A few minutes before 8 o'clock this morning a heavy shock of earthquake was experienced here, lasting five seconds. Three distinct oscillations were plainly felt, the vibrations running from northeast to southwest.—*S. F. Chronicle*, December 9, 1895.

Fullerton: a heavy shock, closely followed by a lighter one, was felt here early this morning.—*S. F. Chronicle*, December 9, 1895.

Napa: a distinct shock was experienced, lasting several seconds.—
—*S. F. Call*, December 10, 1895.

1895. December 12; Ukiah; 12h. 40m. a. m.

A slight shock. The oscillations were from east to west.—*S. F. Call*, December 13, 1895.

1895. December 23; Santa Barbara; about 9h. 30m. p. m.

An earthquake was felt which lasted several seconds.—Newspaper report.

1895. December 28; Mount Hamilton.

9h. 12m. 13s. a. m., Pacific standard.—R. G. A. 9h. 12m. 01s. a. m., Pacific standard, by seismograph clock. Recorded on both seismographs. The Ewing instrument shows a disturbance lasting about ten seconds in each horizontal component, and about six seconds in the vertical.

North and south.—The waves of shortest period and greatest amplitude occurred in this component, beginning within one second of the starting of the plate. The vibrations are of short period, but smooth and regular. The largest one measured had a double amplitude (magnified) of about ⅛ mm. and a period of one-fourth second, which according to the formula gives an intensity of 32 mm. per second and would be between I and II of the Rossi-Forel scale. The main portion of the disturbance lasted about five seconds, some tremors for ten seconds.

East and west.—The first few vibrations are of short period, followed by slower vibrations of about two seconds. The greatest amplitude (double and magnified) is about ¼ mm.

Vertical.—Two waves of about two and one-half seconds each and a double amplitude of about ¼ mm. (magnified).

The waves are all too small to measure with any great accuracy.

EARTHQUAKES ON THE PACIFIC COAST, 1896.[1]

1896. January 3; Esquimault, B. C.; 10:09 p. m., P. s. t.

"A distinct shock of earthquake."—Reported by E. Baynes Reed, Esq.

1896. January 3; Victoria, B. C.

A severe shock of earthquake was felt here to-night at 10.20 o'clock. Many citizens in the public offices, believing the shock to be produced by the falling in of some large roof, or like cause, hurried to the streets.—Newspaper report.

[1] Included in this list are one or two cases, the correctness of which may be doubted. These cases rest upon newspaper evidence entirely and are of such a nature that there should be confirmatory evidence before accepting them. It has been thought best to include these doubtful cases, however, and they are indicated by some note.

Port Angeles (Wash.): at 10.30 o'clock last night two distinct shocks of earthquake were felt in this city. They were severe enough to shake the chimneys off lamps and the dishes off the shelves (VII).—Newspaper report dated January 4, 1896.

1896. January 8; 9:56 p. m.; Turn Point L. H., Washington.

A shock.—Ms. kindly communicated by the U. S. L. H. Board.

1896. January 5; Cocopah Mountains, via Indio, January 5.

Prospectors report seeing immense quantities of smoke and steam rising off the desert toward the volcanoes below the Cocopah mountains during the day and a bright light at night, showing that the volcanoes in that vicinity are again in active operation. —*S. F. Chronicle.*

1896. January 8; Lake Chapala, Mexico, via San Diego (Cal.), January 12.

Professor E. H. Coffey of this city has just received a letter from a correspondent living near Lake Chapala, State of Jalisco, Mexico, which describes some startling phenomena occurring there. Lake Chapala is a sheet of water fifty miles long and ten miles wide. The formation of the country around it is purely volcanic. On the forenoon of January 8th the residents of one of the small settlements near the western end of the lake were terrified to see a gigantic whirlpool raging far out on the waters. The water rose in great serpentine movements and from all directions rushed towards a common center, where a vast cavity seemed to exist. At the same time a heavy rumbling, apparently in the bowels of the earth, took place. The whirlpool was caused by the sudden sinking of a large portion of the lake's bottom. The disturbance continued for twenty minutes, and before it subsided several pleasure boats were drawn into the whirlpool and disappeared with their occupants. It is estimated that a score of lives were lost.—*S. F. Examiner*, Jan. 13.

1896. January 25; Carson, Nevada.

Professor C. W. Friend reports: "We have had quite a number of earthquake shocks on January 25th and 27th, 1896; they were rather peculiar. On the 25th the first noticeable one occurred at 4.45 a. m., and was the heaviest that day. I also noticed one at 4.46 a. m. and 5.02 a. m., both light. The motion W. to E. was hardly perceptible.

We had quite a number of shocks on the 27th:

7.59 a. m. S. to N. (II),
8.34 a. m. W. to E. (III),
11.04 a. m. S. W. to N. E. (III),
11.19 a. m. S. W. to N. E. (I),
1.01 p. m. S. W. to N. E. (IV),
6.32 p. m. S. W. to N. E. (II),

and quite a number of very light tremors between, which I noticed, being quiet in the building. The seismographs did not record a spot larger than one-tenth inch on the plate for all of these, although some of the shocks were quite severe, so much so that it scared a great many people. On the 25th I hung up a one-ounce plumb bob on a fine thread three feet long in a glass case fastened to a stone wall, and it was all I could do to determine the motion by it; all the shocks, including those of the 25th, were vertical and produce a very strange feeling."

1896. January 27; Carson, Nev.

The first heavy shock was about 8.30 o'clock in the morning, and it was quick and lively. It rattled the glass and china in everybody's cupboard, made the windows shake and got several lazy people out of bed (V?). The next was about 11 o'clock and was also quite sharp. At 1 o'clock came the heaviest of all, and it shook every building in the city. The Capitol building was particularly well shaken, and inside of a minute there was a rush to the basement of the building to see the record of the seismograph. It had been deflected about an eighth of an inch by each shock and had also recorded small shocks all through the day.

The Signal Service records showed a very unsettled barometer. Rapid changes occurred and their suddenness was unequaled by anything recorded since last July. These shocks were all graded as No. III, Rossi-Forel scale. There were two others during the day that graded I and II respectively. The first was north and south, the second east and west and the last three southwest and northeast. They were principally vertical.

The jar at 1 o'clock made a large crack in the side of the Government building and shook some of the plaster from the ceiling of the county building (VII).—*S. F. Call.*

1896. February; Tauquiz Peak, via Los Angeles, February 4.

A special to the *Times* from San Jacinto says: There is considerable excitement here over what appears to be an eruption of part of the San Jacinto mountains called Tauquiz Peak, twenty miles from here. The streets of San Jacinto have been crowded with people looking through telescopes at the ominous clouds of smoke which have hung over Tauquiz all day. When first noticed at 9 o'clock the vicinity of the peak was hazy with smoke. Within the next hour this cleared away and glasses leveled at the extinct volcano were able to detect a straight line of smoke ascending. Soon this disappeared and then puff, puff, came more black smoke, like that which pours out of the smokestack of a locomotive.

The smoke has continued to pour out of Tauquiz all day, and everybody is much excited, fearing an eruption. This peak has been

pronounced by scientists an extinct volcano.—*S. F. Chronicle*, February 5, 1896.

This report has not been confirmed.—C. D. P.

1896. February 5; Tauquiz Mountain, via San Bernardino, February 5.

Parties who have returned from the San Jacinto Mountain report that Mount Tauquiz gives out mysterious rumblings and that smoke is plainly visible. To-day smoke was seen from this city. —*S. F. Chronicle.*

1896. February 5; Tauquiz Mountain, via San Bernardino, February 7.

Mount Tauquiz, a spur of the San Jacinto Mountains, and well known to be an extinct volcano, situated about twelve miles from the town of San Jacinto, is again reported to be giving forth smoke. Two men from San Jacinto say a column of vapor can be plainly seen rising from the highest point and that it looks nearly as white as snow. Reports of this mountain being in a state of active eruption have been numerous for several days, and to-morrow a party of newspaper reporters will leave the city on an expedition to Tauquiz. The last four miles of the trip will have to be made through banks of snow several feet in depth, the mountain being covered with snow this season of the year and being 10,000 feet in height.—*S. F. Examiner*, February 8, 1896.

1896. February 5; Tauquiz Mountain, via San Bernardino, February 9.

It is reported to-day that people in and about Mount Tauquiz are getting ready to leave the vicinity, as the action of the mountain, to say the least, is very threatening.

The first that was noticeable in its strange demeanor was a whistling sound—not shrill, but hoarse and guttural-like. This was followed by a deep roar like distant thunder, followed by peal on peal.

This continued for several days, when one morning the Indians in camp were startled by a shock like that of a heavy earthquake and immediately smoke was seen issuing from the mountain's peak, at first in thin white layers, followed immediately by puffs like from the smokestack of an engine. This has kept up almost incessantly up to date.

It has been handed down in Indian history in that neighborhood that Mount Tauquiz once belched forth volumes of fire.—*S. F. Call*, February 10, 1896.

1896. February 6; East Clallam (Wash.); 9h. 55m. p. m.

Quite a well-defined shock. The direction of the temblor was from west to east. It lasted about a minute. Every house in the town, large and small, was shaken to its very foundations, but as far as can be learned no damage was done.

The Indians on Neah Bay reservation all felt the shock. The same shock was also experienced on Tatoosh Island about the same time. The captain of the bark Edinburghshire, lying at anchor in the bay, says the shock was felt by every person aboard his vessel. Some of the sailors became so scared that they wanted to take to the ship's boats.—*S. F. Chronicle.*

1896. February 13; Redding.

A slight earthquake shock was felt in this city about 10 o'clock this forenoon. The shock was more perceptible in the western part of the city and on the hill upon which the county court-house stands.

Weaverville: three successive shocks of earthquake were felt very perceptibly here at five minutes to 10. They were of short duration with a vibration from south to north. Buildings of more than one story received a hard shaking.

Eureka: at 9.55 o'clock this morning a sharp shock of earthquake, vibrating from north to south, was felt in Humboldt county.—*S. F. Examiner*, February 14, 1896.

1896. February 15; Los Angeles.

A distinct shock of earthquake was felt here at 2.52 p. m. The temblor lasted several seconds. Large buildings of substantial structure were considerably shaken. In the court-house the shock was distinctly felt by the county officials and their deputies, and they were frightened.

Pasadena: Pasadena was visited by a slight earthquake shock at 2.57 o'clock this afternoon, lasting about fifteen seconds. The wave seemed to pass from northwest to southeast.—*S. F. Call.*

1896. February 15; Los Angeles.

A slight shock, lasting about two seconds, was felt in this vicinity at 2.45 o'clock this afternoon.—*S. F. Chronicle.*

1896. March 15; Burrard Mountains, B. C., via Vancouver (B. C.), March 16.

One of the Burrard mountains, directly opposite Vancouver and ten miles distant, is believed to have been in a state of eruption last night. Numbers of persons vouch for the accuracy of the statement. C. Harris, a reputable lawyer, declares that dense smoke and flames poured from the mountain for several minutes. No one has scaled the mountain, so that its geological formation is not known. In view of the fact that several shocks of earthquake occurred here in the past year, the story is believed by many.—Newspaper report.

This report has not been confirmed.—C. D. P.

1896. March 19; 4:01 a. m.

Carson (Nev.), light.—C. W. F.

1896. March 20; 11:25 p. m.

Carson (Nev.), light.—C. W. F.

1896. April 2; Portland (Oregon).

About 3.20 a. m. a single shock of brief duration was felt here. The shock was felt as far south as Salem.

McMinnville (Or.): the inhabitants were awakened at 3.17 this morning by an earthquake (VI). Two or three distinct shocks followed in quick succession, with a loud rumbling noise coming from the west. The earth appeared to tip toward the east.—*S. F. Chronicle.*

1896. April 28; San Francisco; 2h. 57m. p. m.

A slight shock, lasting a very short time. It was observed by none of the weather bureau officials on the tenth floor of the Mills building.

"We were in the office of the Alaska Commercial Company at 310 Sansome Street when the shock occurred," said Professor Davidson. "All who felt the shock agreed that the movement was from east to west. The shock was very light and of short duration, lasting not more than a second, if that long. My son took the time, which was 2.57 p. m."—*S. F. Chronicle,* April 29, 1896.

1896. April 28; Alameda.

A disturbance was registered by Mr. Perrine's instrument, the principal motion being north and south.

1896. June 5; 10:20 p. m.; Cape Blanco Lighthouse (Oregon).

"Tower vibrated considerably for about 30 seconds. I could not say positively that it was caused by an earthquake."—Mss. kindly communicated by the U. S. L. H. Board.

1896. June —; Big River (Cal.) via Ukiah, June 23.

Considerable excitement was created on the coast of Mendocino "a few days ago" by an immense tidal wave. The swell was seven feet higher than ordinary and rushed up Big River with great force. The great wall of water is attributed to the Japanese earthquake.—*S. F. Chronicle,* June 24, 1896.

1896. July 3; San Diego; 9h. 27m. p. m.

A severe shock of earthquake. It lasted for several seconds. The oscillation was from north to south and was quite pronounced.—Newspaper report.

1896. July 13; Berkeley.

Slight record.—Professor Soulé.

1896. July 23; Vallejo; 1h. 50m. a. m.

A sharp shock. The vibrations were from southeast to northwest. —*S. F. Chronicle.*

1896. July 25; Berkeley.

Slight record N. and S. [?].—Professor Soulé.

1896. July 26.

Same as July 25 [?].

1896. August 11; Mount Hamilton; 8h. 58m. 7s. ± p. m.

P. s. t. Rossi-Forel (II).—E. S. Holden.

No record of the above on either of the seismographs.

1896. August 11; Alameda.

Mr. Perrine's seismograph shows quite a complicated tracing, the principal disturbance being east and west.

1896. August 17; Merced.

At 3.40 o'clock this morning Merced was visited by an earthquake which lasted about three seconds. The roll was from north to south and shook things up quite lively for the time. Many clocks stopped as a result (VI).

Visalia: a slight earthquake shock was felt here early this morning; a very slight temblor followed in about five seconds by three distinct wave-like motions in quick succession. The direction the waves traveled seemed to be a little north of west. The time, as fixed by different observers, was from 3.29 to 3.30 o'clock.—*S. F. Chronicle.*

Visalia: at 3.26 o'clock this morning Visalia was shaken by an earthquake. There were two distinct shocks. Many persons were awakened and alarmed (VI).—*S. J. Mercury*, August 18, 1896.

1896. August 18; Mount Hamilton.

11h. 0m. 24s. ± p. m. P. s. t. Rossi-Forel III.—E. S. Holden. 11h. 0m. 13s. p. m. P. s. t.—A. L. Colton.

Napa: a slight shock was felt here this afternoon.—*S. F. Chronicle.*

1896. August 18; Evergreen, Santa Clara Co.; 11h. 00m. 15s. p. m., P. s. t.

I was awakened by a slight earthquake running apparently from north to south.—Wm. Wehner.

1896. August 19; Alameda.

A slight disturbance was recorded by Mr. Perrine's seismograph. The direction of motion could not be determined.

1896. August 26; Mount Hood, Oregon.

Newspaper dispatches report the narrow escape of a party of tourists on Mount Hood on the afternoon of August 26 from an avalanche. The dispatches convey the impression of a volcanic eruption, but it seems entirely possible to explain the occurrence without any such assumption. A slight earthquake may have accompanied, or even caused, the avalanche. No reports have been received of any disturbances elsewhere on that day.

1896. September 1; Pinole, Contra Costa County.

[At 1 o'clock p. m. the works of the California Powder Company exploded. There were three separate explosions, the heaviest one being the mixing-house with its 15,000 pounds of dynamite. This explosion was not noticed at Mount Hamilton, nor did the seismographs or barometers record any tremors.]

1896. September 10; Santa Rosa; 3h. 45m. a. m.

A sharp shock. The vibration was north and south.—*S. F. Chronicle.*

1896. September 24; Mount Hamilton.

5h. 25m. 30s. ± p. m. P. s. t. R. F. (III).—E. S. Holden.

5h. 25m. 45s. p. m. P. s. t. R. F. (I). L. O. main building creaked, but did not notice any particular motion. There was a slight mark on the plate of the duplex seismograph.—C. D. P.

1896. September 30; Descanso.

—Cal. S. W. Service *Bulletin.*

1896. October 19; Santa Rosa; about 6 a. m.

Quite a severe earthquake shock. The vibrations were from north to south, lasting about three seconds. No damage.—*S. F. Chronicle.*

1896. November 3; Mount Hamilton.

10h. 58m. 44s. ± 1s. a. m. In my office rattled stove, lamp-shade, etc. Three or four short, sharp shocks, all within 1½ second.—W. W. Campbell.

1896. November 11; Cahto.

Two shocks of more than ordinary note were felt here at 2 o'clock this morning. They shook crockery from shelving, stopped clocks, etc., doing no material damage. The vibrations were from east to west and the duration was about four seconds (VI).—*S. F. Chronicle.*

1896. November 29; Mount Hamilton.

11h. 3m. 37s. a. m. P. s. t. An irregular, slight shaking lasting 5s. or 6s. Not exactly like the vibrations of an earthquake, but could find no other explanation, R. F. (I). I was in the 12-inch dome at the time. No record on the seismographs.—C. D. P.

1896. December 8; Mexico.

A heavy earthquake occurred to-day at the various Pacific ports of this republic, the first shock coming at 9.30 a. m. and the second, an up and down and very alarming one, at 1.30 p. m., and at 5 p. m. the third shock occurred. No casualties are reported.—*S. F. Chronicle*, Dec. 9, 1896.

1896. December 17; Santa Barbara.

" A tidal wave, the largest in the history of Santa Barbara, washed over the boulevard at 8 o'clock this morning, carrying back with

it a large section of that beautiful and expensive driveway. The boulevard was built some five years ago and bulkheaded so securely that it was thought to be impervious to the action of the waves, but the bounding billows carried off a portion of asphaltum and solid masonry, heavy framework and iron in its receding grasp, nearly fifty feet square and eight feet deep. A large sand hill between the boulevard and ordinary high tide was carried completely out to sea."—*S. J. Mercury*, Dec. 18, 1896.

1896. December 22; Mount Hamilton.

1h. 52m. 41s. P. s. t. R. F. (V).—E. S. H.

1h. 52m. 43s. P. s. t. (middle of shock). 3s. duration. Did not rattle dishes.—W. W. C.

1h. 52m. 44s. P. s. t. (end of shock).—W. J. H.

1h. 52m. 44s. P. s. t. (end of shock), duration estimated at 2s.—A. L. C.

1h. 52m. 37s. ± 1s. P. s. t. Time noted at cottage.—R. G. A.

1h. 52m. 40s. p. m. P. s. t. (beginning). Second floor brick house. Lasted 2s.-3s. Light tremors increasing to two well-marked vibrations, then dies out suddenly. Building creaks. Direction seemed to be N. and S.—C. D. P.

The duplex seismograph recorded a small disturbance, about N. W. and S. E.—1.5 mm. × 1 mm. N. E. and S. W. The clock only of the Ewing instrument was started.

1896. December 31.

The following notes are from Mss. kindly communicated by the U. S. Lighthouse Board. The reporters are the lighthouse keepers:

Coquille River (near Bandon), Oregon: the station went into operation Feb. 29, 1896. No earthquakes during the year.

Cape Arago, Oregon: no record of earthquakes from January 4, 1891. No previous record.

Umpqua River, Oregon: station went into operation January 1, 1895. No record of any earthquakes.

Haceta Head, Oregon: station went into operation April 1, 1895. No record of any earthquakes.

Cape Meares, Oregon: station went into operation January 1, 1890. No record of any earthquakes.

Tillamook Rock, Oregon; also Point Adams, Oregon; no record of any earthquakes.

Cape Disappointment, Washington; also Willapa Bay, Ediz Hook, New Dungeness, West Point (all in Washington), have no records of any shocks on their books. Narrowstone Point, Washington, went into operation April 7, 1896. No earthquakes recorded.

Patos Island, Washington, went into operation December 1, 1893. No earthquakes recorded.